Now it's continuous-dress grinding
page 113

What is holding back automatic assembly?
page 129

# American Machinist

MAY 6, 1957 PRICE 50 CENTS

Cylinder bores honed automatically to controlled size — see page 2

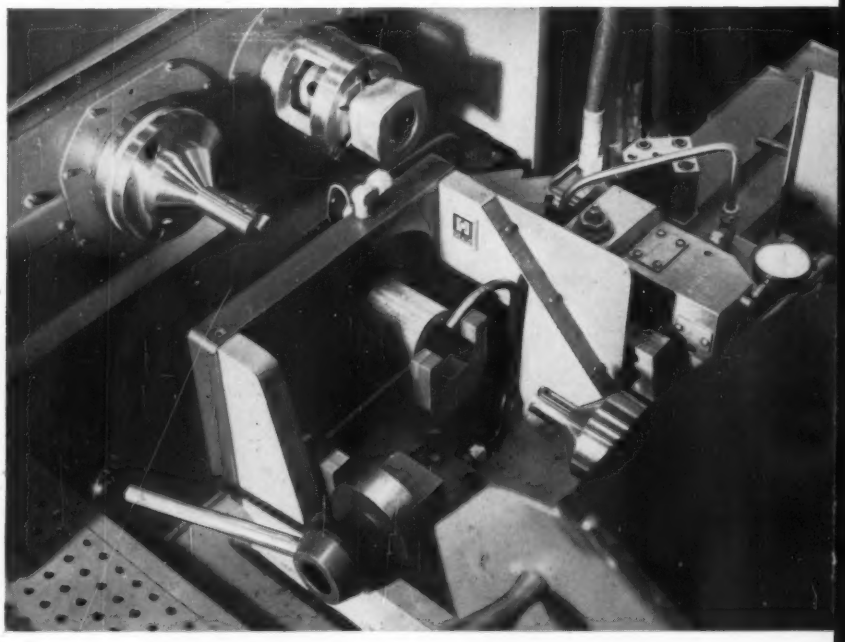
IN ANY MACHINE TOOL OPERATION,

# where do you look for the PAY-OFF ?

- ☐ On the machine itself
- ☐ In subsequent assembly operations
- ☐ In the finished product

## On a Heald BORE-MATIC, pay-off time at the machine is only the beginning!

***For example:*** A manufacturer of portable tools purchased the Model 222 Bore-Matic shown here, for boring and facing various sizes of tool housings. Although results showed a worthwhile time saving of about 20%, this alone was hardly enough to justify the cost of the machine. But analysis of subsequent assembly operations some time later showed substantially reduced assembly times which *fully justified the investment.* Although average Borizing time is only 1 or 2 minutes per piece, the assembly operations take from 30 minutes to 2½ hours and involve as many as five pieces that now fit exactly right because they've been through the Bore-Matic. However, the customer reports that the *major* advantage of the machine is improvement in quality of the finished product. Under previous methods, frequent trouble was encountered due to distortion of metal from improper clamping and locating. So this Heald Bore-Matic not only saved machine time and cut production costs, but also contributed to a *better* and *more saleable product.*



THE *precision production* that you get from a Heald Bore-Matic or Internal Grinder is not an end in itself. Actually, it's the start of a chain reaction that will be felt in subsequent assembly operations and even in the performance and saleability of the finished product as well.

When you measure the length of time it will take for a machine to pay for itself, it's important to look at the *overall* picture. Take the savings you get at the machine. Add the savings from reduced assembly time. And if you can put a dollar value on the resulting improvement in product quality, add this too. You'll find that . . .

*IT PAYS TO COME TO HEALD*

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**THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.

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NEWS REPORT ..

. . . Spot News . . 97
. . . Washington . . 99
. . . Detroit . . 101
. . . Machine Tools . . 103
. . . What's Ahead . . 107
. . . General News . . 162
. . . Field Report . . 168
. . . Names . . 170

Departments...

Letters . . 90
Editorial . . 111
Practical Ideas . . 150
Round Table . . 145
. . . Discussion . . 220
Talking Shop . . 161
New Equipment . . 172
New Books . . 234
New Films . . 238

## contents for May 6, 1957

VOLUME 101, NUMBER 9

**Now it's continuous-dress grinding . . .** Combination of diamonds in a roll similar to a crusher roll and a special hydraulic feed make it possible to dress wheels while they are grinding for a new level of automation. *By Anderson Ashburn*. . . . 113

**Five ways to pierce rings . . .** And you can adapt the methods to a wide variety of perforating, piercing, notching, and light forming operations. *By Buckley Sullivan*. . . . 116

**We cut polishing costs 35% . . .** Intricate contours, recesses, and undercuts need be no obstacle to a fine finish. *By A D Vanderbilt, Porter-Cable Machine Co.* . . . 120

**Precision gages insure accurate plastic parts . . .** How to mold plastic to tolerances normally associated with machining. *By John E Donovan, Auburn Button Works, Inc.* . . . 122

**Shop Shots . . .** Molded conveyor belts, a carbide gun drill, studs end welded to axles, universal joggling attachments, and a continuous seam welder. . . 124

**Streamlined layout sparks multi-story operation . . .** Interlacing conveyors that sense the right time to feed parts, plus assembly lines with mechanized equipment, provide coordination in a multi-story, multi-building layout. *By Charles Emerson*. . . . 126

**Space check your gears . . .** Quiet gears depend as much on spacing as on involute, lead, and parallelism. Here is a summary of space-checking methods. *By Fred Bohle, Illinois Tool Works*. . . . 141

**The little "squirt" grows up . . .** Special welding jobs can be handled with the equipment you have—plus ingenuity. *By Paul Galambos and Fred Hersey, O G Kelley Co.* . . . 146

**Automatic size control insures accuracy . . .** Individual bores in a cylinder block are honed to meet tolerance range for selective assembly. . . . 148

SPECIAL REPORT NUMBER 443

**What's holding back the automatic assembly machine? . . .** Mostly the fact that each machine now must be tailor-made. We need basic principles and standard assembly-machine elements. Here is one outline of how this can be done. *By George H Kendall, Sr, Jerry A Host, and George H Kendall, Jr, Kenhos Corp.* . . . 129

REFERENCE BOOK SHEETS

**"Safe" loads for slings, IV . . .** Conclusion of the reference tables to supplement the article on calculating crane lifts (*AM*—Apr 22 '57, p163). . . . 155

**Dye-penetrant inspection I, II . . .** How to clean parts and inspect by this method, based on several years experience in training shops to use dye penetrants. *By William D Briggs, Turco Products, Inc.* . . . 157

# American Machinist *Chips*

***Cover . . .***
Selective assembly is carried one step further than usual in one auto plant by honing cylinder bores to size to match the pistons. The Micromatic Hone on the cover does the job. Details are in the story on page 148.

***Continuous-dress Grinding . . .*** A few days ago the first announcement was made of a new technique for dressing grinding wheels that has the widest implications for the future of automatic grinding. Still highly experimental, it holds promise of providing a way to dress the wheel continuously *while it is grinding*. Although you may have heard about it already through newspaper or other sources, we feel it is so important that we have given you as much information as we could get on the present state of the devolpment, plus our speculation on what it holds for the future. You'll find it all in our lead article on page 113.

***Automatic Assembly . . .*** Your reaction to the title of our current Special Report ("What's holding back the automatic assembly machine?") is likely to be, "I didn't know anything was." You could have a point there, yet despite the rapid expansion of this group of machines (see our Special Report in *AM*—Sept 10 '56, p129), automatic assembly could grow much faster if you didn't have to wait months or years for a machine and then cope with the "debugging" problem. There may be a way out of this dilemma and the Special Report starting on page 129 suggests it. It is a solution that is easier to propose than to adopt but you'll find it provocative and worth your attention.

***Quiet Gears . . .*** It is common practice to worry about the involute, lead, and parallelism for gears that must transmit power quietly and efficiently. It is not so common to worry about the spacing of the gear teeth, though this is just as important. Fred Bohle, manager of machine and gear development for Illinois Tool Works, provides a summary of the methods you can use when you "Space check your gears." See page 141.

***Tooling Growth . . .*** The tooling for a job is probably never so good that it couldn't be better. A case in point is the piercing of holes in rings. At one company, the tooling for this operation progressed from simple press tooling through five stages to special machines that pierce 37 holes at once to close location tolerances and "set" the ring to final dimensions at the same time. Buckley Sullivan describes this progression in "Five ways to pierce rings" on page 116. You will find tooling ideas in each method and we would not be willing to bet that the latest method will turn out to be the last one.

***Coming . . .*** *AM* for May 20 will give you an impressive collection of material on how to machine cast iron with maximum tool life. At the opposite extreme you'll find a suggestion on how to save money in cutting stainless by forgetting tool life. There are reports on using ceramic tools for short runs, on the results of studies of tapping, on lapping, and the next in our series in which a management consultant cuts you in on his trade secrets.

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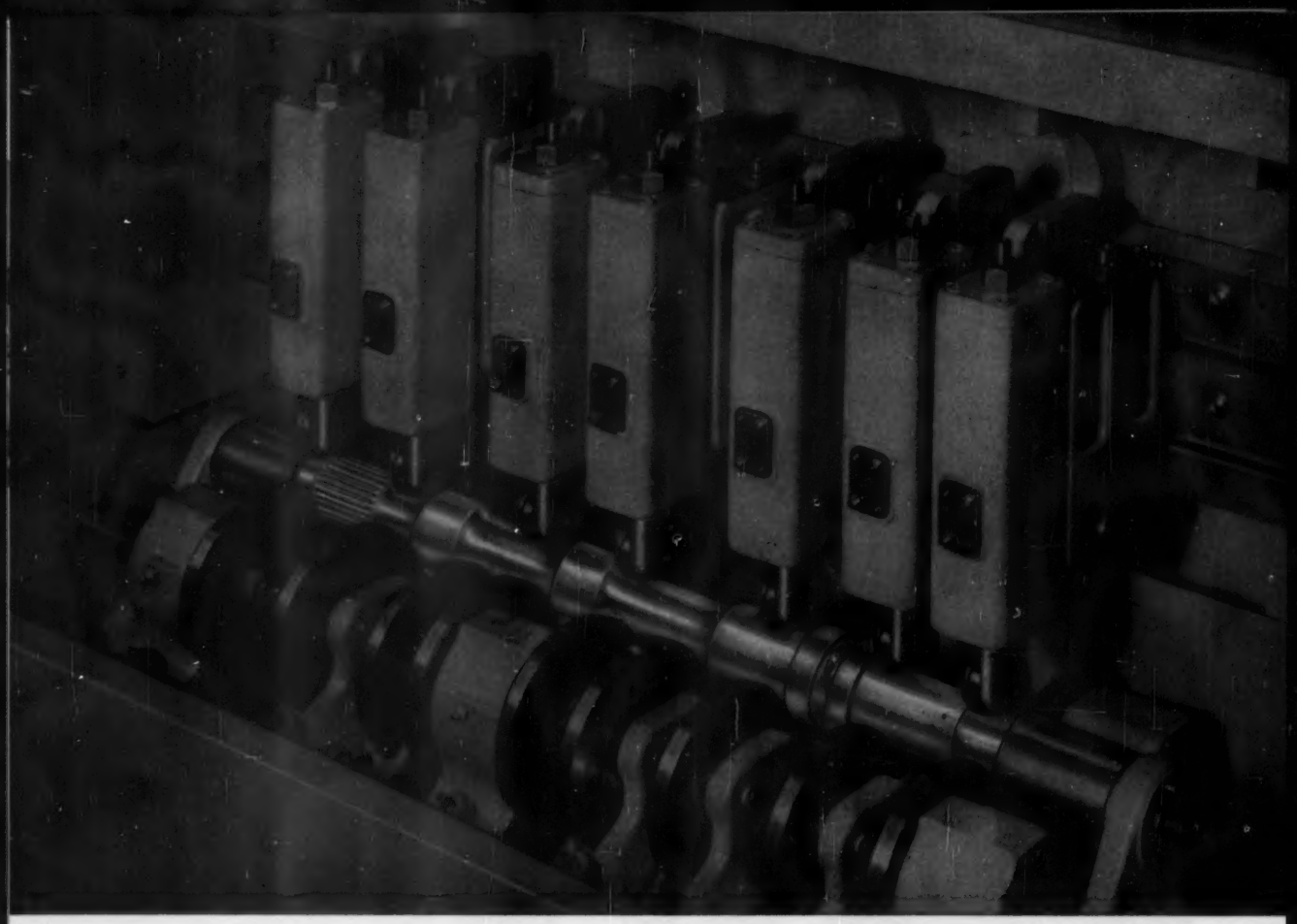

# How to eliminate *your* shaft distortion problems

Distortion during hardening is a major production problem.

The Gleason No. 140 Rolling Quench Machine corrects this difficulty, because the quenching and straightening operations are performed at the same time. Because cold straightening is eliminated, valuable production time and expense are saved, and the quenched parts have less residual stress.

Shafts cannot distort because they are rolled under pressure throughout the quenching operation. The operator puts the hot part on the lower rollers and starts the machine. From there on, the quenching operation is automatic. Rolling speed, pressure, and oil flow are pre-set to suit the work that is being quenched.

The automatic quenching cycle saves operator time, and gives *uniform* results for all parts quenched. The pre-set metallurgically correct oil flow gives uniform hardness.

The Gleason No. 140 Rolling Quench Machine is equally suited for small or large quantities. It accommodates shafts $\frac{9}{16}$″ to 4″ in diameter, 6″ to 40″ in length, with integral cams or shoulders up to 8″ diameter. Tooling can be arranged to hold parts on diameters or centers. Unusual shapes can be handled with additional tooling. Write for further information.

*The Gleason No. 140 Rolling Quench Machine also handles multiple quenching of short shafts.*

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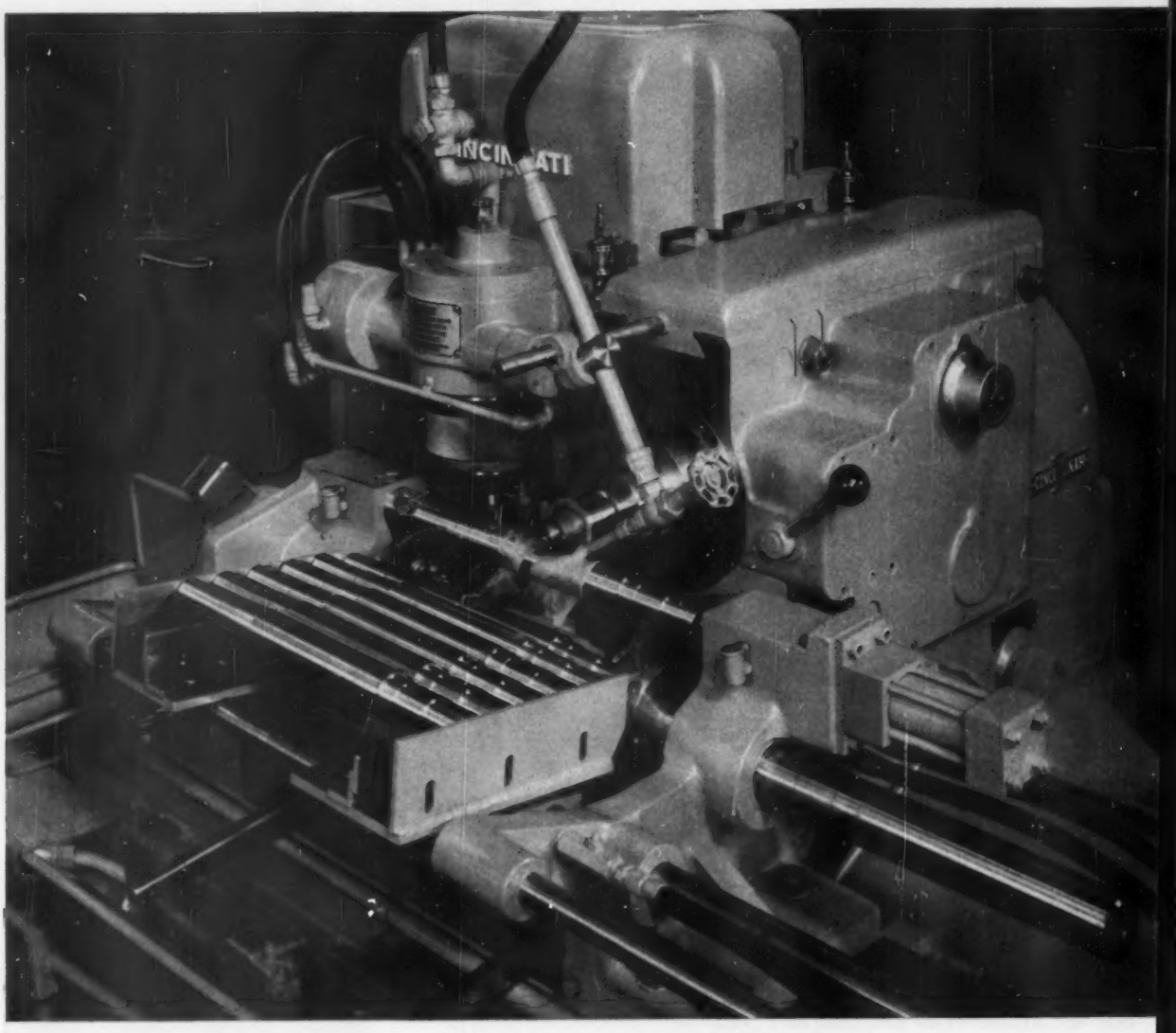
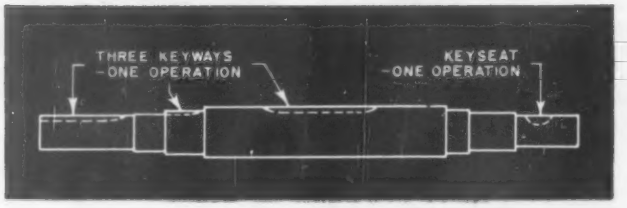
# POWERMATIC



Automatic four-position turret stop (left of cutter) determines depth of keyways milled in various diameters on motor shafts. This unit is attached to the spindle carrier of a Rise-and-Fall Powermatic Milling Machine.




One of the many shafts milled on the CINCINNATI Powermatic illustrated here.

Production:

keyseat, 220 per hour
keyways, 68 per hour

**MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES**

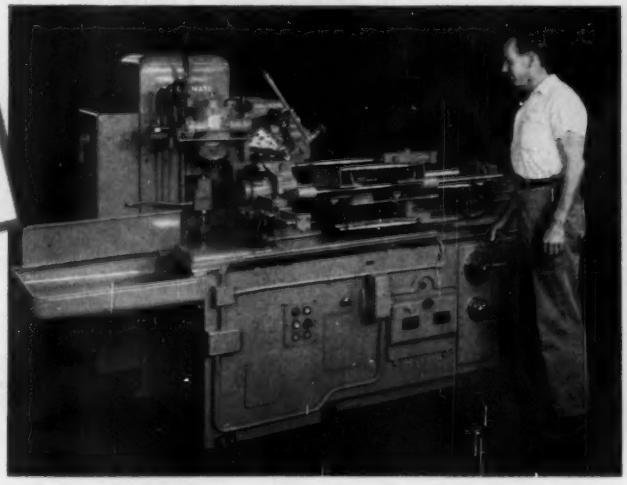
# equipped for automation

## . . . handles small lots having various requirements

A manufacturer of electric motors wanted to gain the maximum benefits from automation in milling the keyways in motor shafts. However, there were two tough problems to solve: 1) shafts are produced in several sizes and manufactured in small quantities, and 2) number and size of keyways vary with each shaft. Cincinnati Automation Specialists, experienced in automatic production long before the word "automation" was coined, decided that the job could be handled at the lowest cost on a CINCINNATI® Plain Rise-and-Fall Powermatic equipped with a universal fixture. This machine has a unique feature—cycle selector—which controls the automatic cycle of the machine and other functions of automation assignable to it. And cycle selectors can be interchanged within a minute or less. ¶ Shafts vary from 1" diameter by 11" long, to 3½" diameter by 30" long. Each shaft requires one keyseating operation, and two, three or four keyways. Depth of cut for the size of keyway desired is automatically controlled by a four-position turret stop, operated by the machine cycle selector. A hydraulically actuated magazine type loading fixture, with interchangeable elements, is also automatically controlled by the cycle selector. ¶ This is but one of many examples of Cincinnati Engineering Service in the field of low-cost automation for small quantities. Our engineers can do a comparable job for the family groups of parts manufactured in your shop. Give us complete information; we will work out a solution.

**THE CINCINNATI MILLING MACHINE CO.**
**CINCINNATI 9, OHIO**

CINCINNATI *POWERMATIC* MILLING MACHINE
CATALOGUE No. M-1913-1.



**Automation for small manufacturing quantities incorporates automatic loading and automatic machine cycling on this CINCINNATI Powermatic Rise-and-Fall Milling Machine. Write for catalog No. M-1913-1. Brief specifications in Sweet's.**

# CINCINNATI

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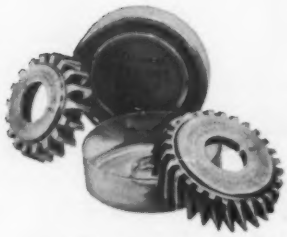
# BETTER GEARS

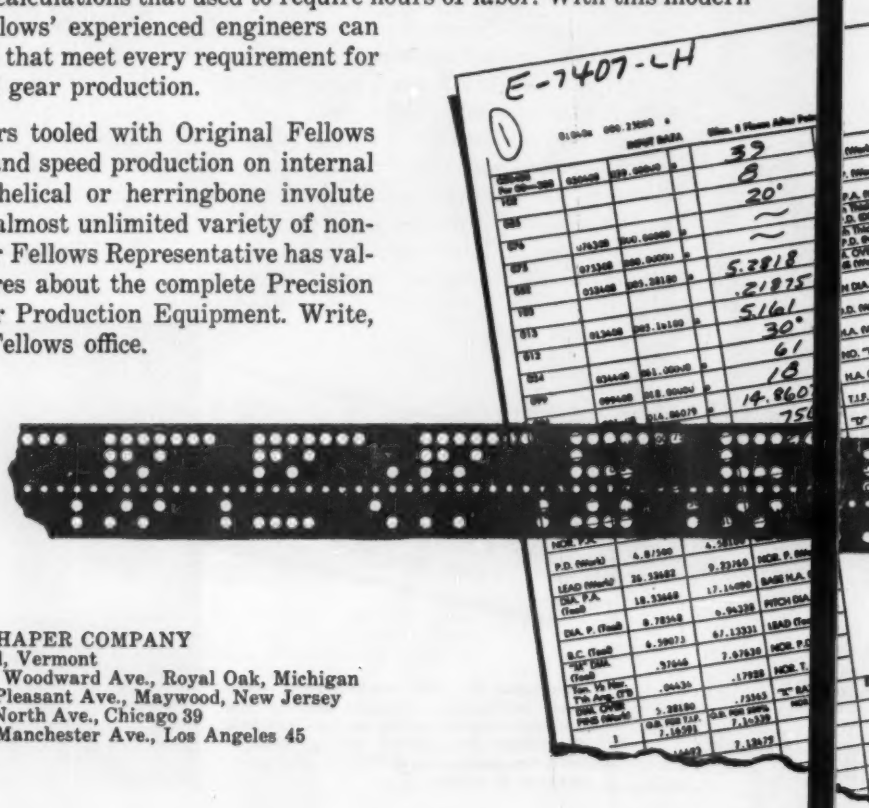
## *Original Fellows Cutters "Computer-Designed"*



Here's how Fellows ensures gear cutter design that meets your most critical requirements! A high-speed Bendix Computer (at right) shortens hours of calculations to minutes, permitting complete mathematical study of all the complex problems of gear and cutter design.

The punched tape holds the basic formulae. This is the computer "program." Variables for a particular Fellows Cutter, Shaving Tool, or Master Gear are typed on the electric typewriter which feeds them into the computer. As fast as the operator can type, the computer makes calculations that used to require hours of labor. With this modern calculating tool, Fellows' experienced engineers can better design cutters that meet every requirement for accurate, economical gear production.

Fellows Gear Shapers tooled with Original Fellows Cutters lower costs and speed production on internal and external spur, helical or herringbone involute gears, as well as an almost unlimited variety of non-involute shapes. Your Fellows Representative has valuable facts and figures about the complete Precision Line of Fellows Gear Production Equipment. Write, wire or phone any Fellows office.

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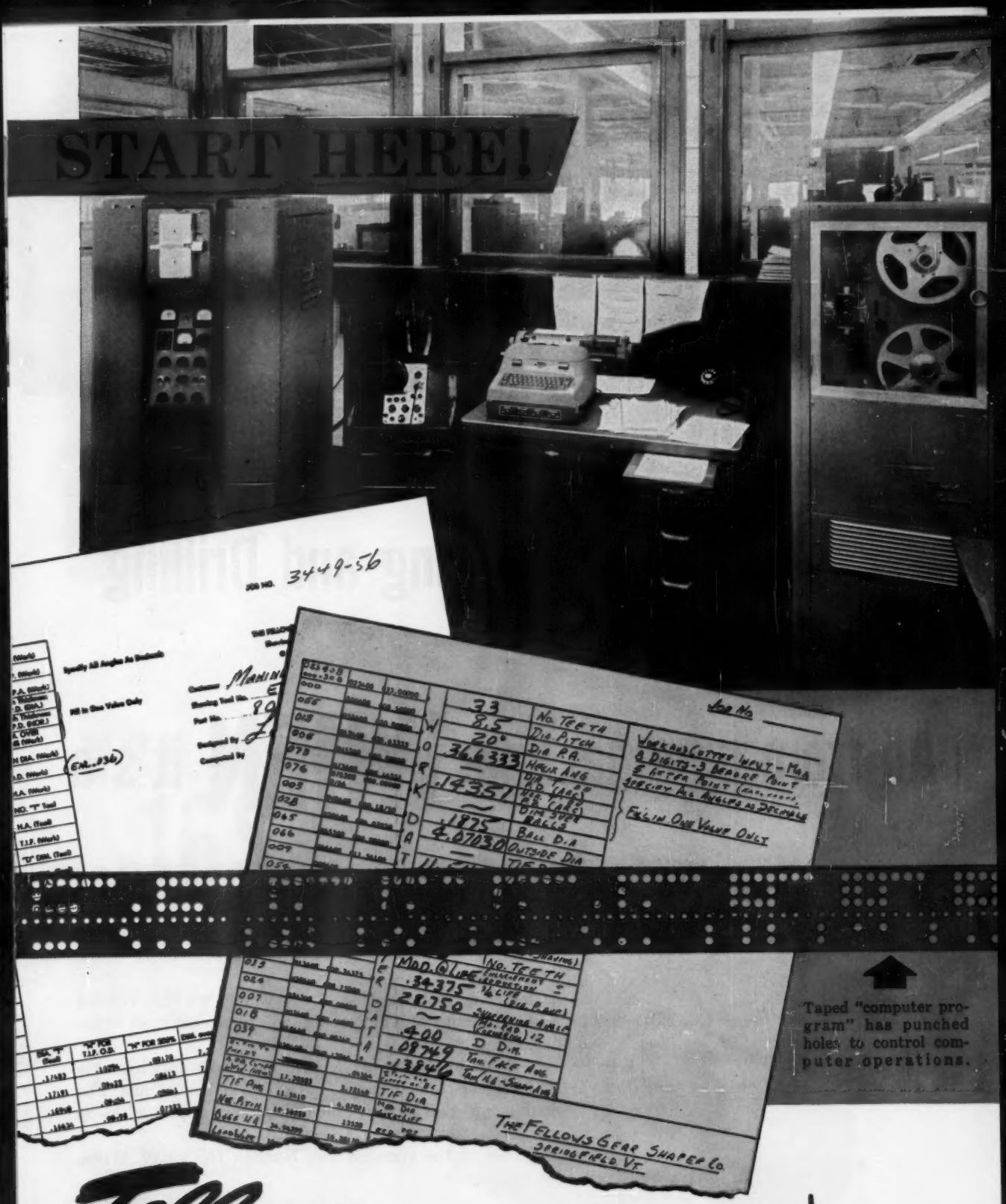


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# PLUS Boring and Drilling

# All from one machine WHEN it's a

You make one investment in one machine . . . and when it's a Van Norman No. 16S, with quill type-adjustable cutterhead, you've got the most versatile machine available.

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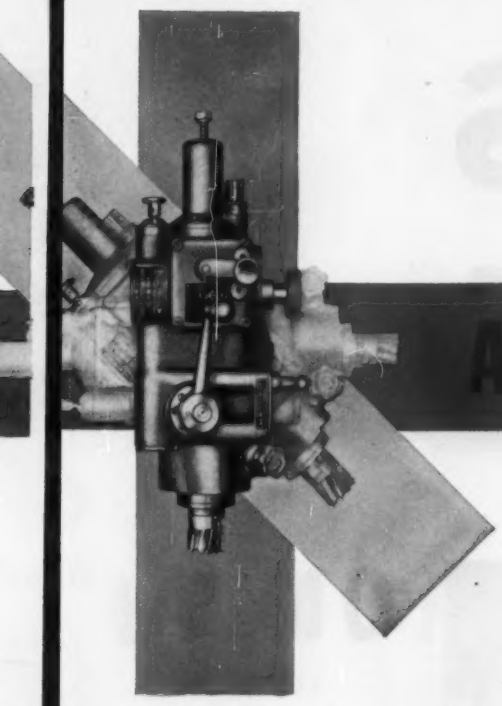
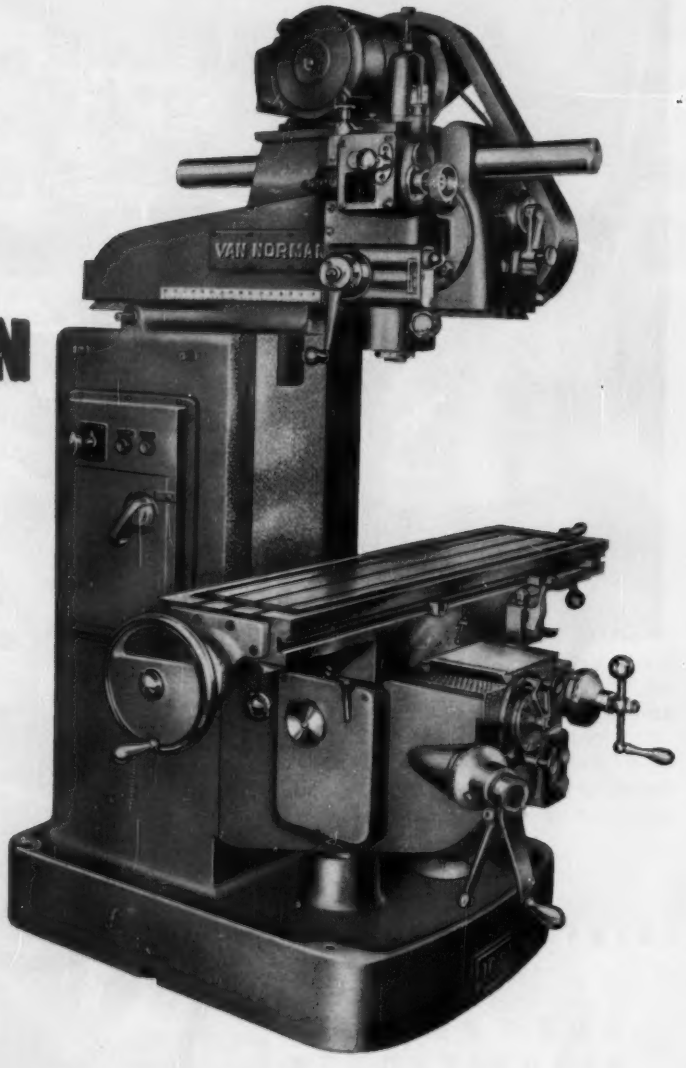


# Angular, Vertical Milling

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Don't wait . . . for extra profit install a Van Norman machine now! They are available on several purchase plans . . . Outright sale . . . On conditional sales contract up to five years . . . Pay as you depreciate up to 10 years.

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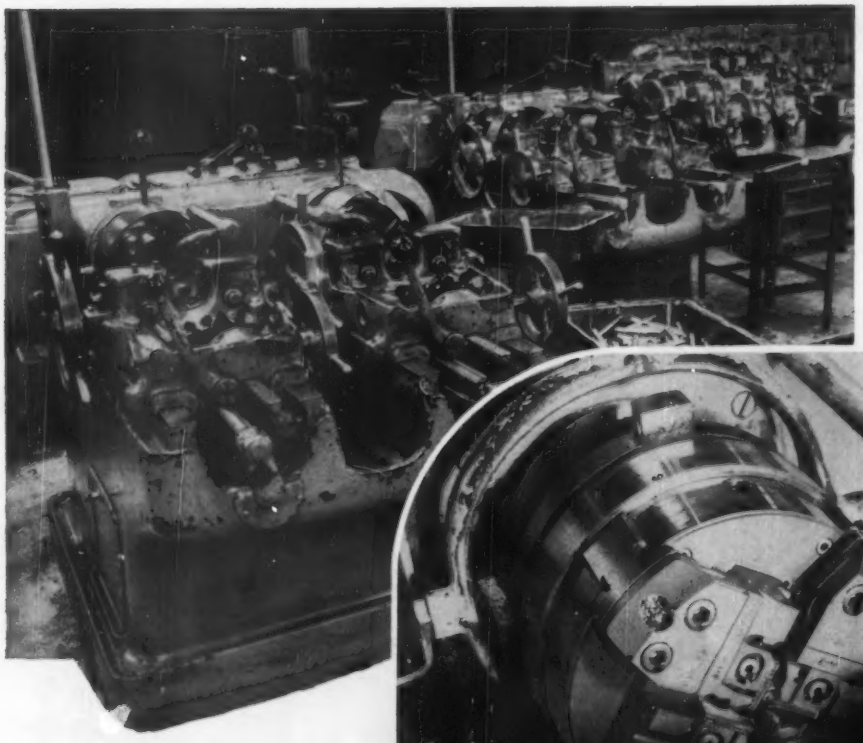
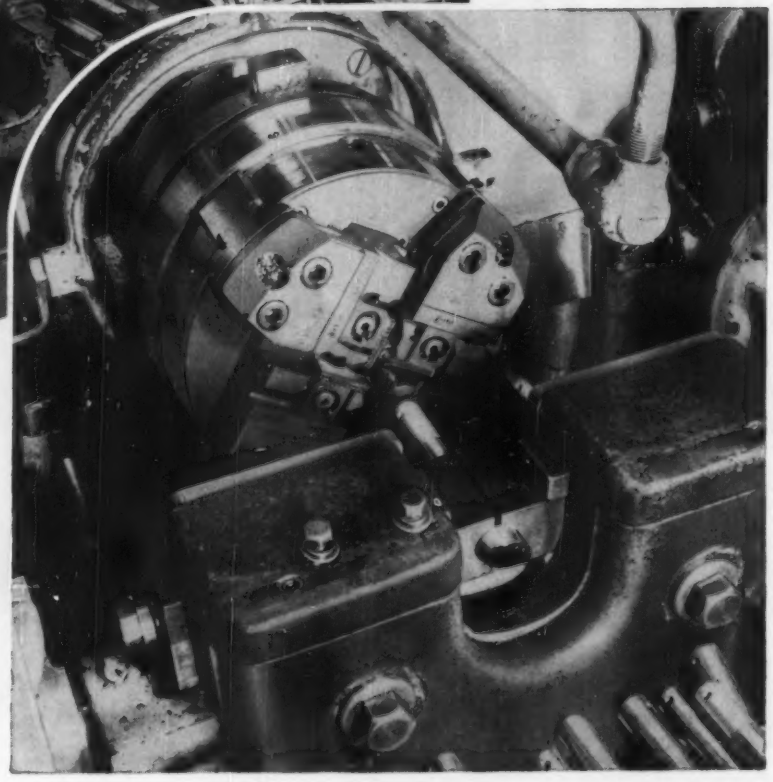
# BOLTS threaded ON A





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# to ±.001

# LANDMACO MACHINE

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Bolt blanks are of 8640 steel of 30-36 Rockwell "C" hardness. 11/16" diameter 16 pitch UN form threads must be cut 1-7/16" long over a cotter key hole. Specifications required a ±.001" tolerance on the Pitch Diameter of the thread, and finished threads are closely inspected for concentricity.

To perform this operation a 1½ LANDMACO Double-Spindle Threading Machine equipped with Leadscrew, Hardened and Ground LANCO Heads, and Chasers of special throat length and hardness was installed. In normal production, this LANDMACO Machine regularly completes 127 threaded pieces per hour cutting at 15 surface feet per minute. On an average 400 threads per head are produced between each regrinding of the chasers.

This installation illustrates the production advantages of LANDIS Equipment for difficult and exacting threading operations. The mechanically-controlled positive feed of the Leadscrew, the maximum rigidity of Die Heads designed for precision threading, and Chasers of special specifications—allow threading hard material with minimum cutting strain. As a result, threads are produced to close tolerances at economical production rates and low tool cost. For further information, ask for Bulletins H-75 (LANDMACO Machines) and F-80 (Hardened and Ground Heads). Please send specifications when writing.

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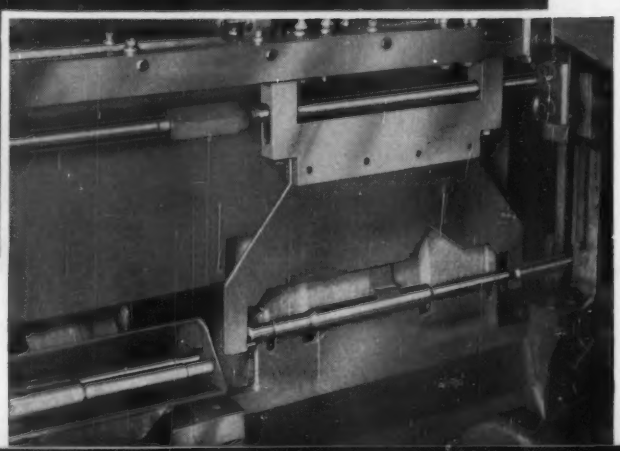
## Improves work uniformity from .0007" to .0003"

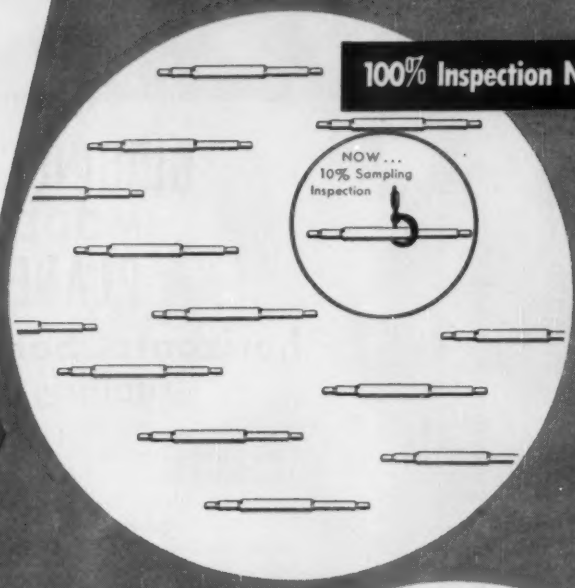
Since using two Landis No. 12½ Centerless Grinders, a major automotive parts manufacturer is now grinding shafts with these results. The superior accuracy of these grinders at high production rates is due to their unmatched rigidity.

12½ Centerless Grinder with automatic loading and unloading.



# Costs

**100% Inspection NO Longer Necessary**

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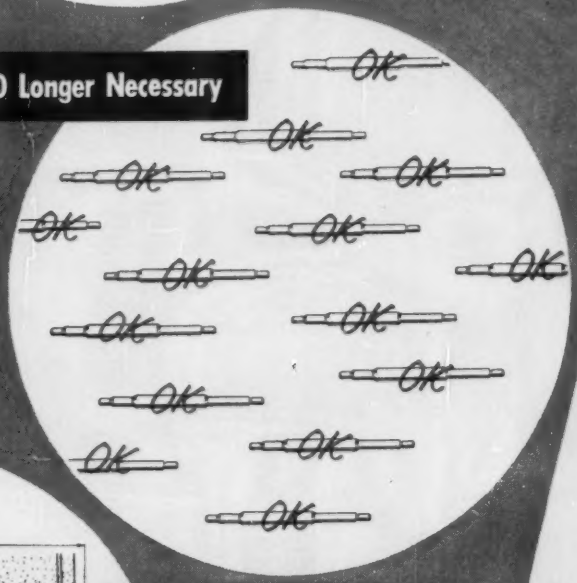
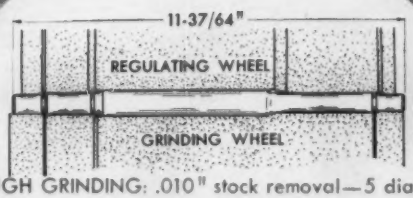
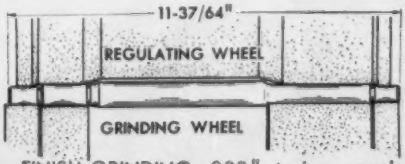



**Grinds 380 Shafts per Hour**




ROUGH GRINDING: .010" stock removal—5 diameters




FINISH GRINDING: .003" stock removal
—4 diameters

LANDIS TOOL COMPANY
WAYNESBORO, PENNA., U. S. A.

**LANDIS**
precision grinders

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## (MODEL 560-P)
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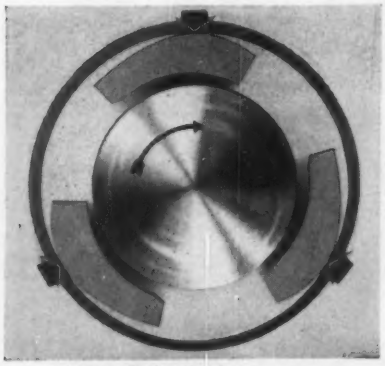
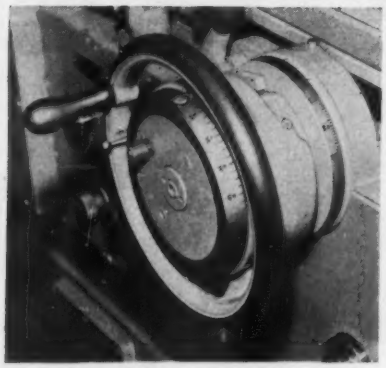
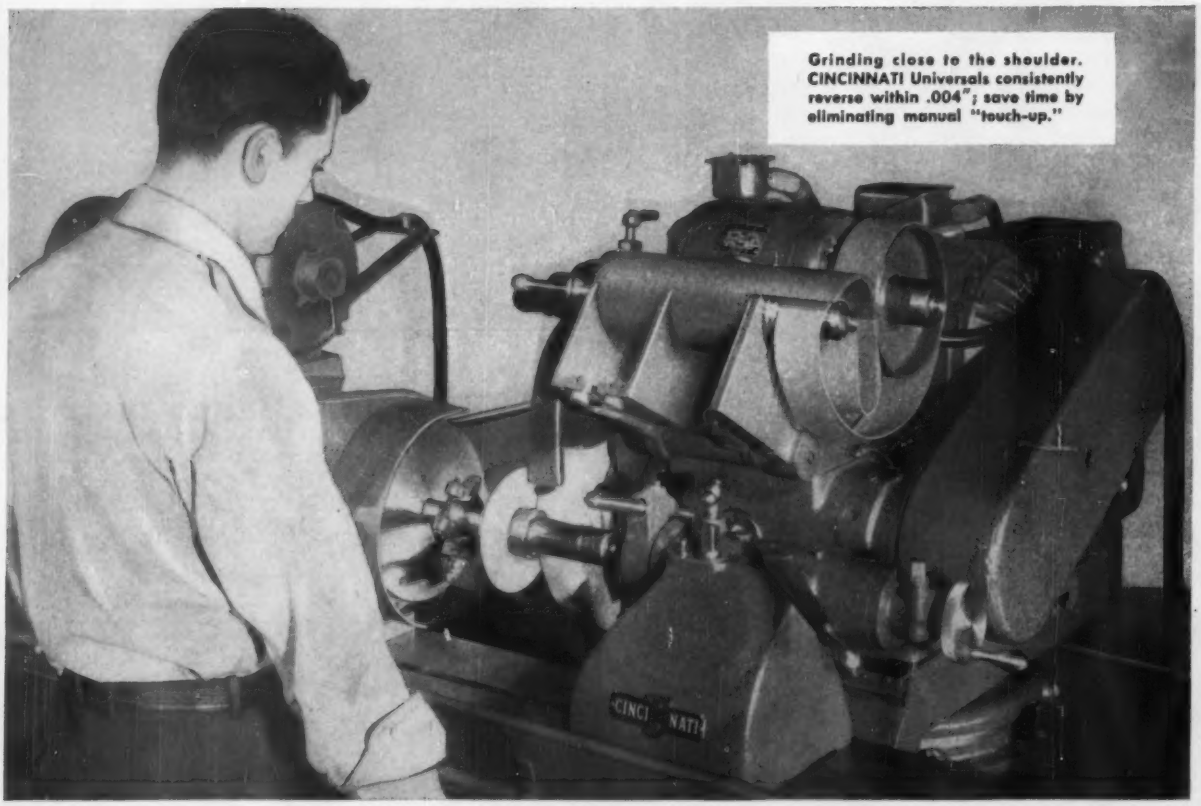
# These Cincinnati
## keep your setup



**FILMATIC Self-adjusting**
grinding wheel spindle bearings



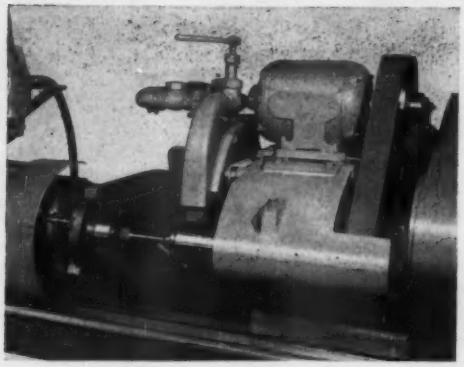
**Two-speed**
cross traverse handwheel


Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."
CINCINNATI

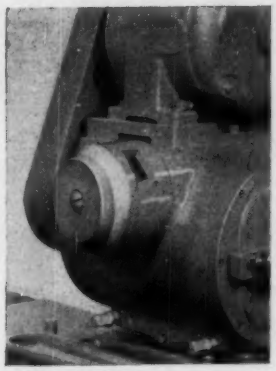
CINCINNATI

# timesavers

## from showing on the cost record



Hinge mounted internal grinding unit



Dial selection of headstock spindle speeds

Small manufacturing quantities may be good for inventory accounting, but they're tough on costs. In precision toolroom grinding, CINCINNATI® FILMATIC Universals offer several ways to eliminate or greatly reduce the setup element of cost.

**FILMATIC grinding wheel spindle bearings** require no adjustment for any job assigned to the machine.

**Two-speed cross feed mechanism** facilitates quick positioning of wheelhead for multiple diameter grinding; incorporates pickfeed all the way to final size.

**Internal grinding unit** is hinged at the front of the wheelhead casting, always ready for internal work.

**Instant work speed selection** for the diameter being ground. Just turn the dial with one hand, that's all there is to it.

**Power rapid positioning** of wheelhead. Saves time and energy, especially when setting up for widely varying diameters (extra equipment).

Other ways in which CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663-1. May we send a copy to you? You will find brief specifications in Sweet's.

Power positioning of wheelhead

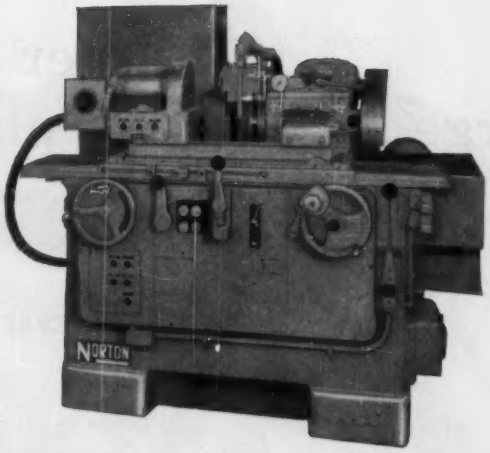
FILMATIC

**CINCINNATI GRINDERS INCORPORATED**
**CINCINNATI 9, OHIO**

**CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES**

**HIGH PRECISION PLUS HIGH PRODUCTION.** Long-lasting accuracy is built into the 4" x 18" Type CTU cylindrical grinder — together with many Norton "Touch of Gold" features that reduce operators' duties and speed production. Remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost.

# Norton 4" x 18" Type CTU cylindrical grinder



Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

For example, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. Then there are optional profit-boosting extras like the new SWIVALIGN Dual Electric Indicator for measuring swivel table adjustment, and an Automatic Wheel Truing Device.

***Get All the Facts***

on how this fast, accurate grinder can add the profit-boosting "Touch of Gold" to your grinding operations. See your Norton Representative, or write direct for Catalog No. 531. And ask about the Norton Lease and Purchase Financing Plans that enable you to modernize while conserving your capital. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

*To Economize, Modernize with NEW*

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**GRINDERS and LAPPERS**

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# $7200 per month saving by large automotive plant after switching to

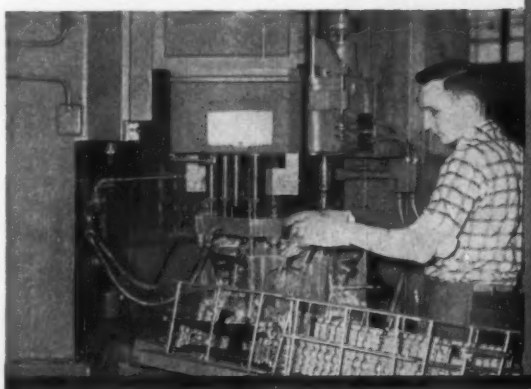
# DASCO D-20

## HEAVY-DUTY SOLUBLE OIL

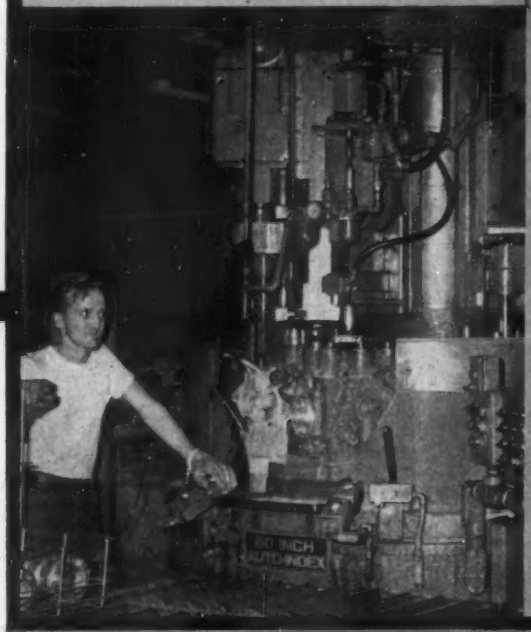
An actual saving of $7200 per month, including labor costs, has been reported by a large automotive transmission plant since switching to Stuart's Dasco D-20—*the first truly heavy-duty soluble oil* formulated and priced for general application!

ONE OIL FOR 365 DIFFERENT MACHINES—This carefully engineered compound eliminates cutting oil confusion—drastically reduces the number of cutting fluids needed in your plant. This plant uses economical Dasco D-20 in standard mixtures on *365 different machine tools*—reducing cutting oil inventory . . . saving service time and cutting oil costs . . . minimizing chance of error—yet taking advantage of all lubricating and cooling properties you expect from a heavy-duty soluble oil.

RANCIDITY ELIMINATED—This user reports that Stuart's Dasco D-20 stays sweet longer—even after long shutdowns. Rancidity is actively resisted by a special germicide additive, the best of a very few germicides that remain effective in the presence of soaps. Stuart's Dasco D-20 has superior wetting ability—remains effective when mixed with water.



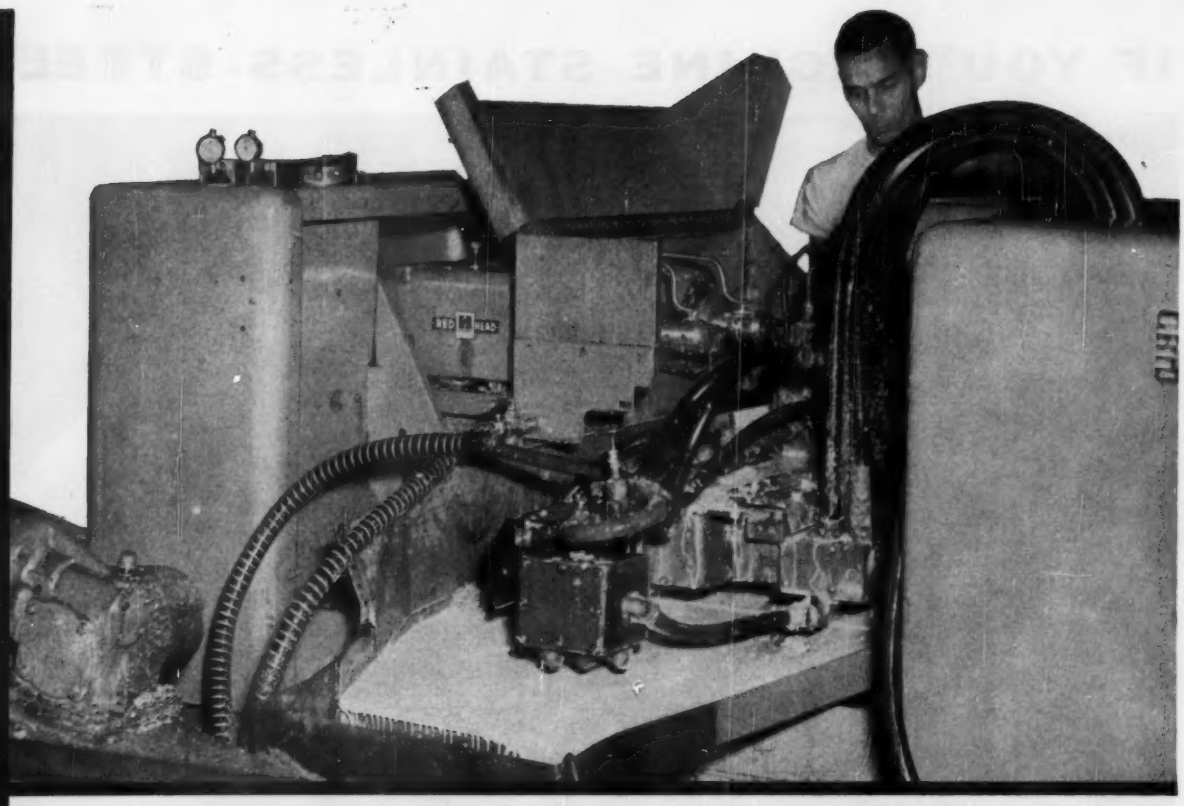
Chips settle faster with Stuart's Dasco D-20, so you have a clean compound in your machine at all times. You get a better finish . . . cooler cutting and grinding.



You can use low-priced Stuart's Dasco D-20 for reaming, boring, drilling, facing, chamfering, milling, tapping, threading, broaching, surface-grinding, and high-speed carbide tool machining.

## For Cutting and Grinding

Stuart's Dasco D-20 maintains or improves efficiency of your cutting and grinding operations. A real heavy-duty emulsifiable oil, it forms a tough, thin film between the cutting tool and the work . . . reducing friction and preventing excessive heating. A wide variety of tough metal-cutting operations, including certain types of broaching, can be done with this *one* low-priced compound. A lean mixture for grinding enables you to take full advantage of improved wheel bonds. Properly applied, it allows you to use high-unit pressure for maximum stock removal . . . keeps wheels open and free-cutting . . . prevents heat checking.



## First low-priced heavy-duty soluble oil with both additives: active germicide and E. P. base

Stuart's Dasco D-20 is the first low-priced soluble oil to offer you both a special anti-rancidity germicide and an extreme pressure base oil additive with high anti-weld and lubricity characteristics. Carefully balanced, high-quality emulsifying agents provide high-grade cooling properties . . . unusual stability for longer life. This multi-purpose, heavy-duty soluble oil gives you ideal characteristics for high-speed machining with carbide cutting tools . . . upgrades finish and tool life on tool steel applications. Stuart's Dasco D-20 has superior wetting ability . . . avoids rust . . . mixes easily . . . keeps machines and parts clean . . . and is preferred by operators.

Phone your
Stuart Service Center

Arrange now to test Stuart's Dasco D-20 on your difficult cutting and grinding jobs.

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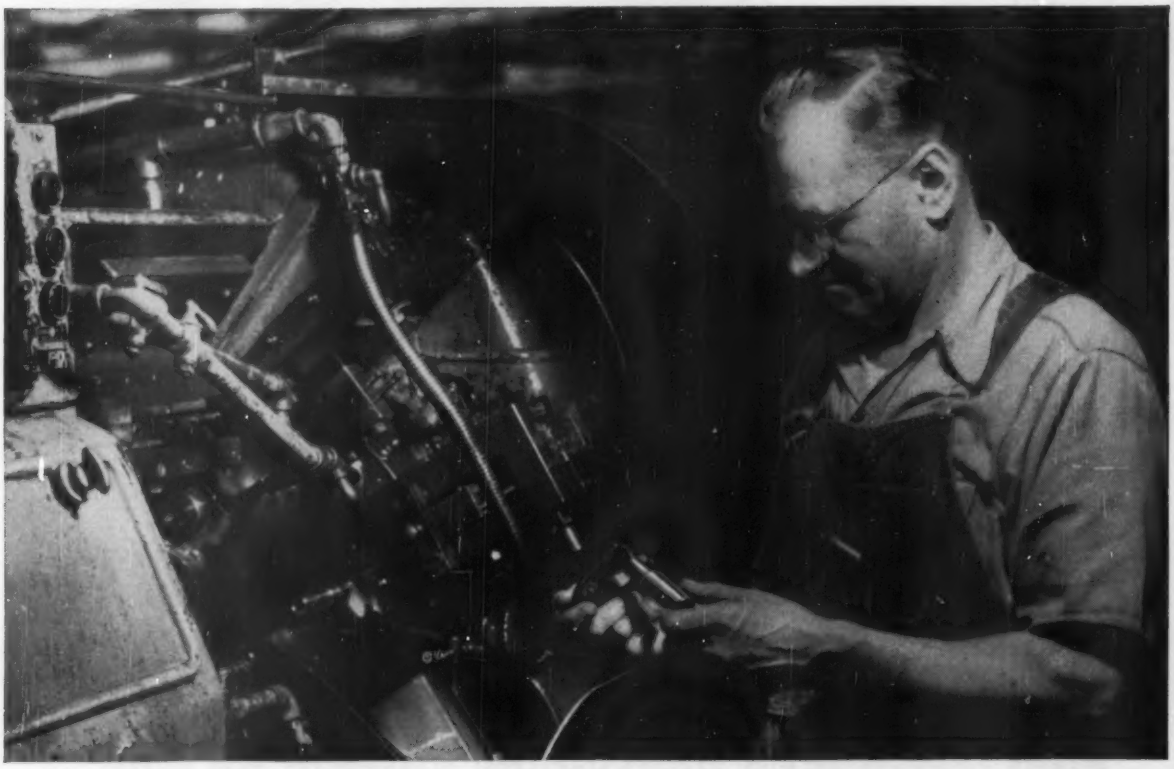
**METALWORKING LUBRICANTS**

# IF YOU MACHINE STAINLESS STEEL



**REPUBLIC COLD DRAWN STEELS** give the hinge pins and pivot ends on the Sherman Digger higher strength, greater hardness and a bright, smooth finish. Controlled physical properties and the cold finishing process provide the manufacturer with dependability and economy. Republic Cold Finished Steels also provide top ratings on feeds and speeds, long tool life, freedom from abrasion. Available in all carbon, alloy, and stainless analyses.

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*World's Widest Range of Standard Steels*

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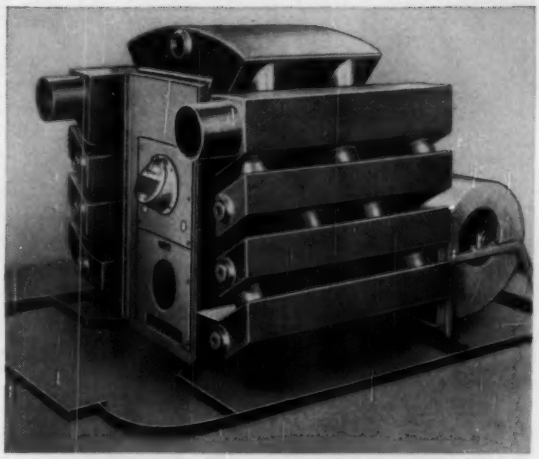
Do you know what causes tools to heat and burn, chatter marks, tapped holes to vary in size, rough threads, tooth breakage, burnished surfaces? Or what feed and speed to use when twist drilling .250 holes in A.I.S.I. 430-F?

The answers to these and many other questions are contained in Republic's *free book,* "How To Machine ENDURO Stainless Steel Bars".

This 96-page, pocket-sized manual is planned to help you obtain the best possible results when machining ENDURO bars. One section contains precise, accurate information on the basic principles of machining and how to correct troubles. Another section explains types and properties of stainless. Forty-two pages are devoted to estimating-tables covering conversion of fractional inches to decimals and millimeters, stock required for 1000 pieces, r.p.m. of spindles at given surface speeds, etc.

If you machine stainless steel parts you'll like this book. You will also like Free-Machining ENDURO® Bars. Here is a metal unsurpassed in high physical and chemical properties to which has been added the advantages of cold drawing: accuracy of section, close tolerance, uniform soundness and a fine surface finish. Two grades, A.I.S.I. Types 416 and 430-F are fully 90% as machinable as Bessemer screw stock. Republic also supplies ENDURO in hot rolled bars, special sections and wire.

Our metallurgists and machining specialists will give you expert, obligation-free assistance on application, processing and use. Just send the coupon if you would like one to call, or for your copy of, "How To Machine ENDURO Stainless Steel Bars".



**REPUBLIC ELECTRUNITE® MECHANICAL TUBING** provides safe, gas-tight joints required by the down-flow construction of this year-round furnace and air-conditioning unit. Uniform diameter, wall thickness, concentricity, strength, and ductility of ELECTRUNITE simplify design and help speed output of superior parts. Quality control from ore to finished tubing assures long, trouble-free service. Available in carbon and stainless steels.

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**STEEL**
*and Steel Products*

# We made this pledge

"Morse . . . will give, grant, bargain, sell and convey unto dealers and users . . . Machinist's Tools . . . made of the best quality of steel, of fine finish, and not excelled as to durability and accuracy."

## He renews this pledge in 1957... your MFD*

"To Have And To Hold said tools with all the privileges thereto belonging to their own use and behoof forever. That we have good right to sell and convey the same as aforesaid, and that we will warrant and defend the same to said grantees."

*Your Morse-Franchised Distributor knows that Morse stands behind this warranty just as solidly today as we did 89 years ago. And in his name and behalf, Morse now re-publishes this warranty as an earnest of good faith backing up every Morse Cutting Tool you buy. Yes, you can bank on Morse . . . and on your Morse-Franchised Distributor.

**MORSE TWIST DRILL & MACHINE COMPANY • NEW BEDFORD, MASS.**
*A Division of VAN NORMAN INDUSTRIES, INC.*
*Warehouses in New York, Chicago, Detroit, Dallas, San Francisco*

# MORSE

# in 1868

Know All Men By These Presents

That we

The Morse Twist Drill & Machine Company

A corporation duly organized under the laws of the Commonwealth of Massachusetts, and doing business at New Bedford, in the County of Bristol, in said Commonwealth; in consideration of good and current coin of the realm in amounts as set forth in the catalogue of said company—which can be readily obtained upon application—will give, grant, bargain, sell and convey unto dealers and users of Machinists' Tools, located in every part of the civilized world, certain tools, hereinafter mentioned, made of the best quality of steel, of fine finish and not excelled as to durability and accuracy. Said tools consist of

Arbors for Drill Chucks; Shell End Mills; Shell Reamers and Face Milling Cutters; Bench Stock and Center Drill Chucks; Counterbores; Countersinks; Solid and Adjustable Counterbores with Bit Point Drills; Dees; Bit Point and Bit Stock Drills; Increase Twist and Constant Angle Drills; Three and Four Groove Drills; Drills with Grooved Shanks; Hollow Drills for deep drilling or long holes; Jobbers' Drills; Letter Drills; Drills with Oil Holes; Taper Square Shank Drills; Wire Drills; Caliper, Plug and Ring Twist Drill and Steel Wire Gauges; Mandrels; Metal Slitting Saws; Milling Cutters; Concave and Convex Cutters; Cutters for Grooving Taps; Cutters with Radial Grooves; Screw Slotting Cutters; T Slot Cutters; Gang Cutters; Sprocket Wheel Cutters; Interlocking Cutters; Involute Cutters; Cutters for Mitre and Bevel Gears; Stocking Cutters for Involute Gears; Adjustable Hollow Mills; End Mills; End Mills with center cut; Shell End Mills; Cutter Mills; Taper Pins; Reamers with Oil Holes; Bit Stock Taper Reamers; Shell Reamers; Expanding Shell Reamers; Fluted Chucking Reamers; Rose Chucking Reamers; Shell and Rose Shell Reamers with Spiral Flutes; Taper Pin Reamers; Bridge Reamers; Locomotive Reamers; Three-Groove Chucking Reamers; Screw Plates with Dies, Sleeves, Sockets; Machinists' Hand Taps; Machine Screw Taps; Nut Taps; Patch Bolt Taps; Pulley Taps; Pipe Taps; Stay Bolt Taps; Stove Bolt Taps; Machines as follows: Bench Centers, Drill Grinding, Face Grinding, Gear Testing and Straightening Press.

**To Have And To Hold** said tools with all the privileges thereto belonging to their own use and behoof forever. That we have good right to sell and convey the same as aforesaid, and that we will warrant and defend the same to said grantees.

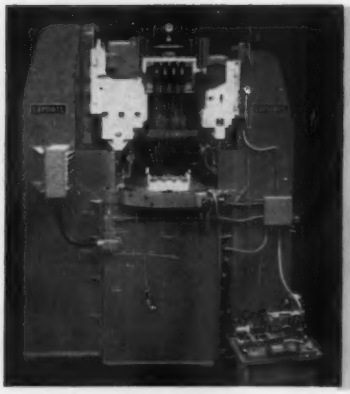
**In Witness Whereof**, We, the said Morse Twist Drill & Machine Co., hereunto set our hand and seal this Sixth day of April, A. D. 1905.

L.S.

Morse Twist Drill & Machine Co.

# means "THE MOST" in Cutting Tools

Producing 380
complete wrenches per hour,
BROACHING CLIPPED
PRODUCTION TIME
66⅔%



## No need to keep your fingers crossed when LAPOINTE—BROACHING

**You'll never get "hexed"** when using Lapointe-Broaching for these double-hex openings, or for any other broaching application engineered by Lapointe. No jinxes, no uncertainties . . . because Lapointe engineers have the experience which enables them to anticipate and avoid the trouble spots.

**This box wrench,** ⅜" to $1\frac{1}{16}$" **size,** is an example of the amazing savings that can be made by broaching. Using one operator to load and unload, the rough forging (Fig. 1) is drilled (Fig. 2), broached (Fig. 3), and chamfered (Fig. 4) — all operations being performed on *both ends* and fully automatic, indexed on the 42-inch hydraulically operated rotary table.

**Saving over two-thirds** the previous production time required by single-point tooling operations, this special Lapointe Vertical Pull-Down Broaching Machine (15 tons, 48-inch stroke) is expected to pay for itself in two years through labor savings alone!

**If you would like to discuss** a possible broaching application, a qualified Lapointe Field Engineer will gladly call on you, on request.

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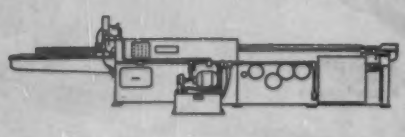
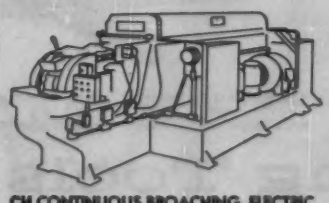
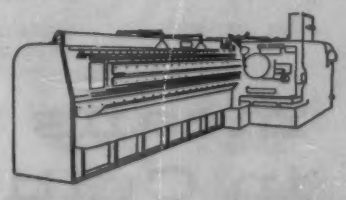


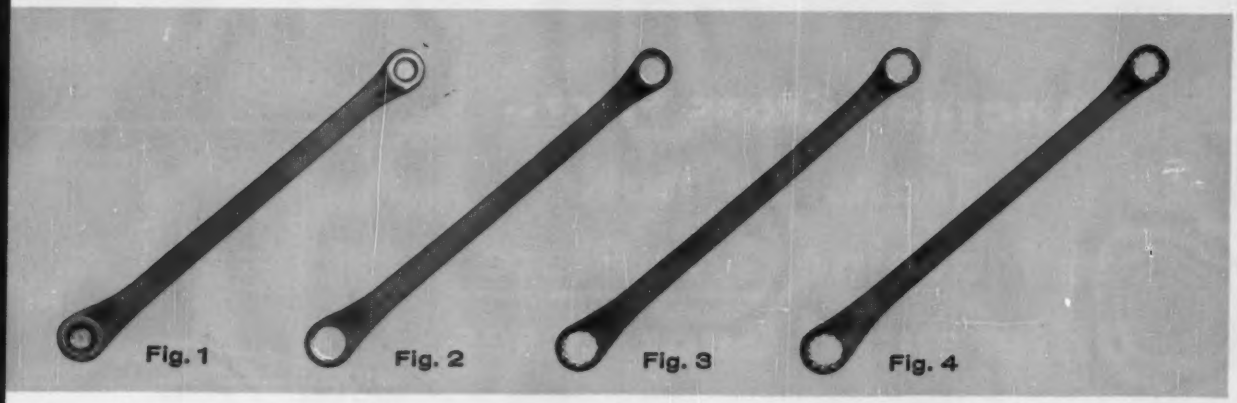
60" STROKE HORIZONTAL, ELECTRIC



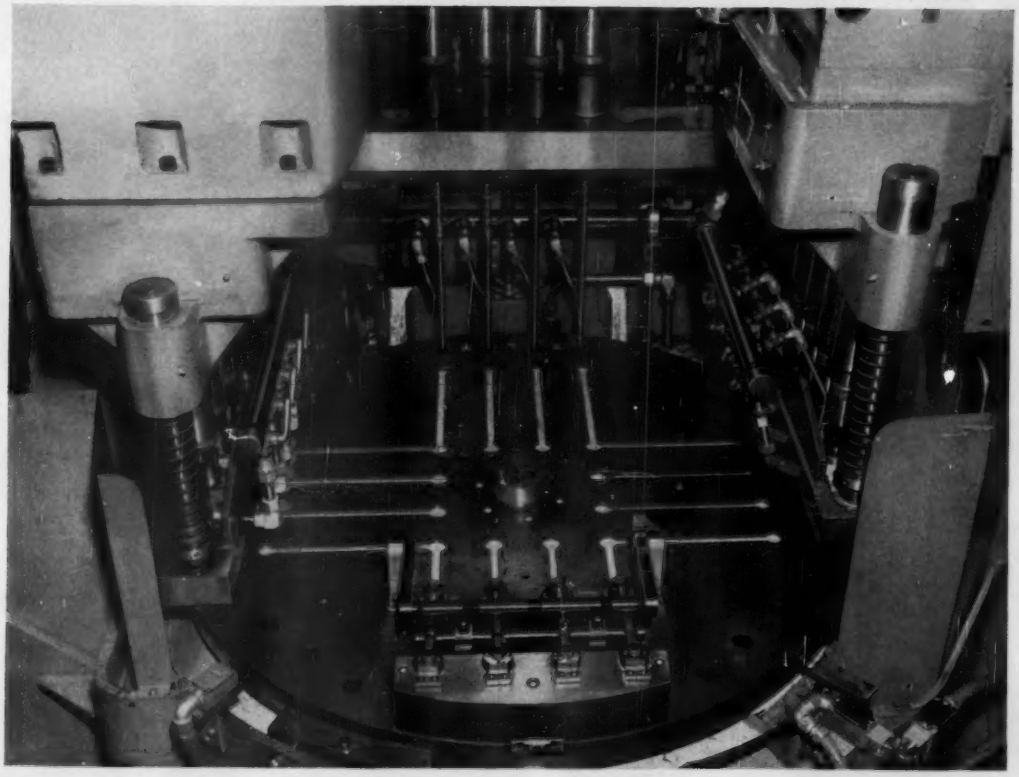
CH CONTINUOUS BROACHING, ELECTRIC

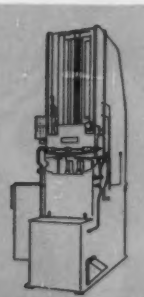


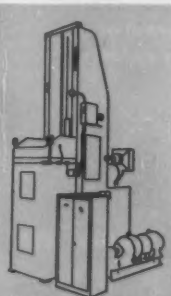
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

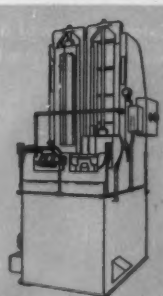



## this Double-Hex opening in Box Wrenches!




VUE-Z VERTICAL
FULL-UP ELECTRIC


SRVE SINGLE RAM
VERTICAL, ELECTRIC


DRVE DOUBLE RAM
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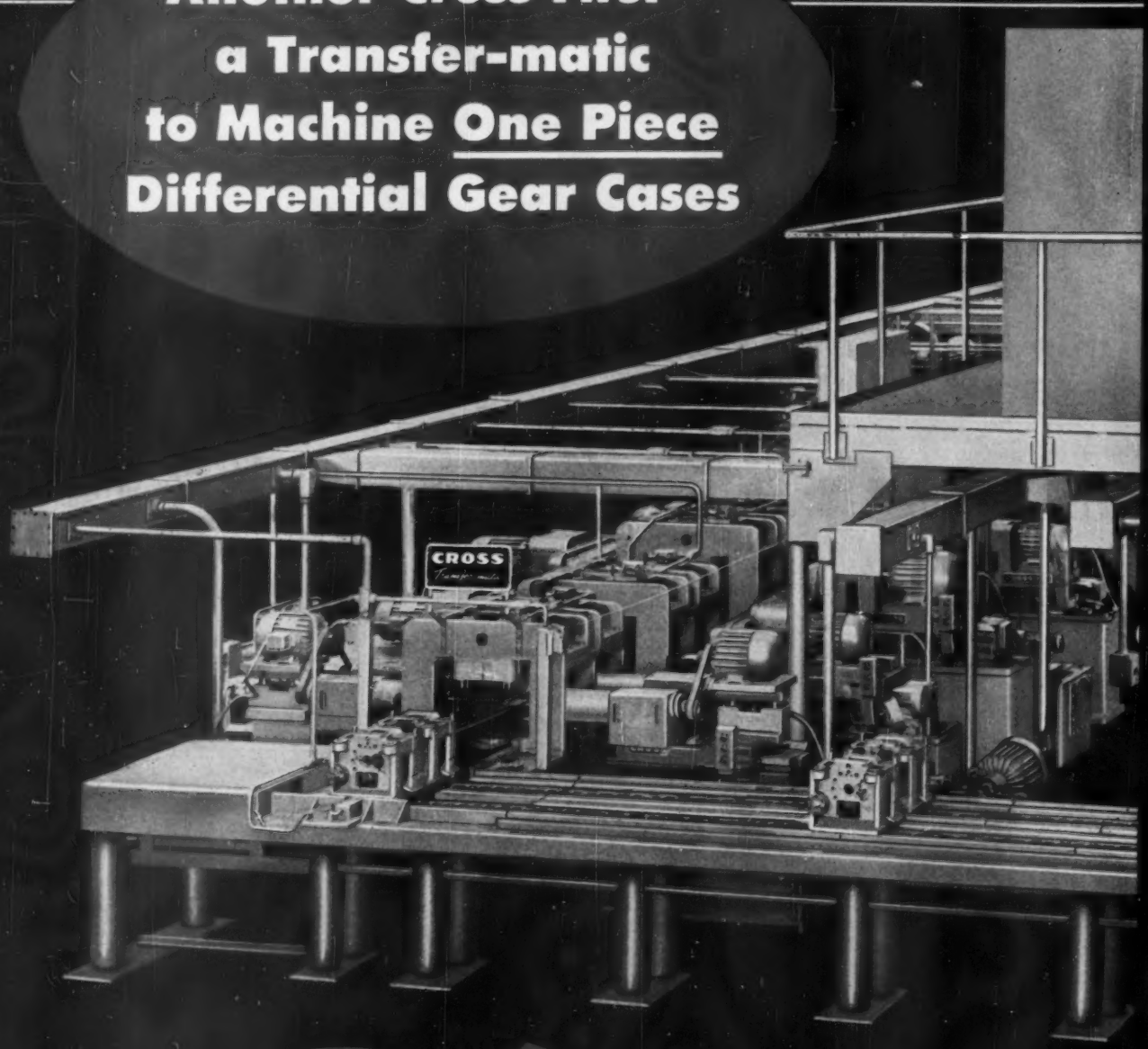
LAPOINTE
known to be the best in
BROACHING

# Another Cross First – a Transfer-matic to Machine One Piece Differential Gear Cases



Cutaway view of differential gear case showing machined surfaces.

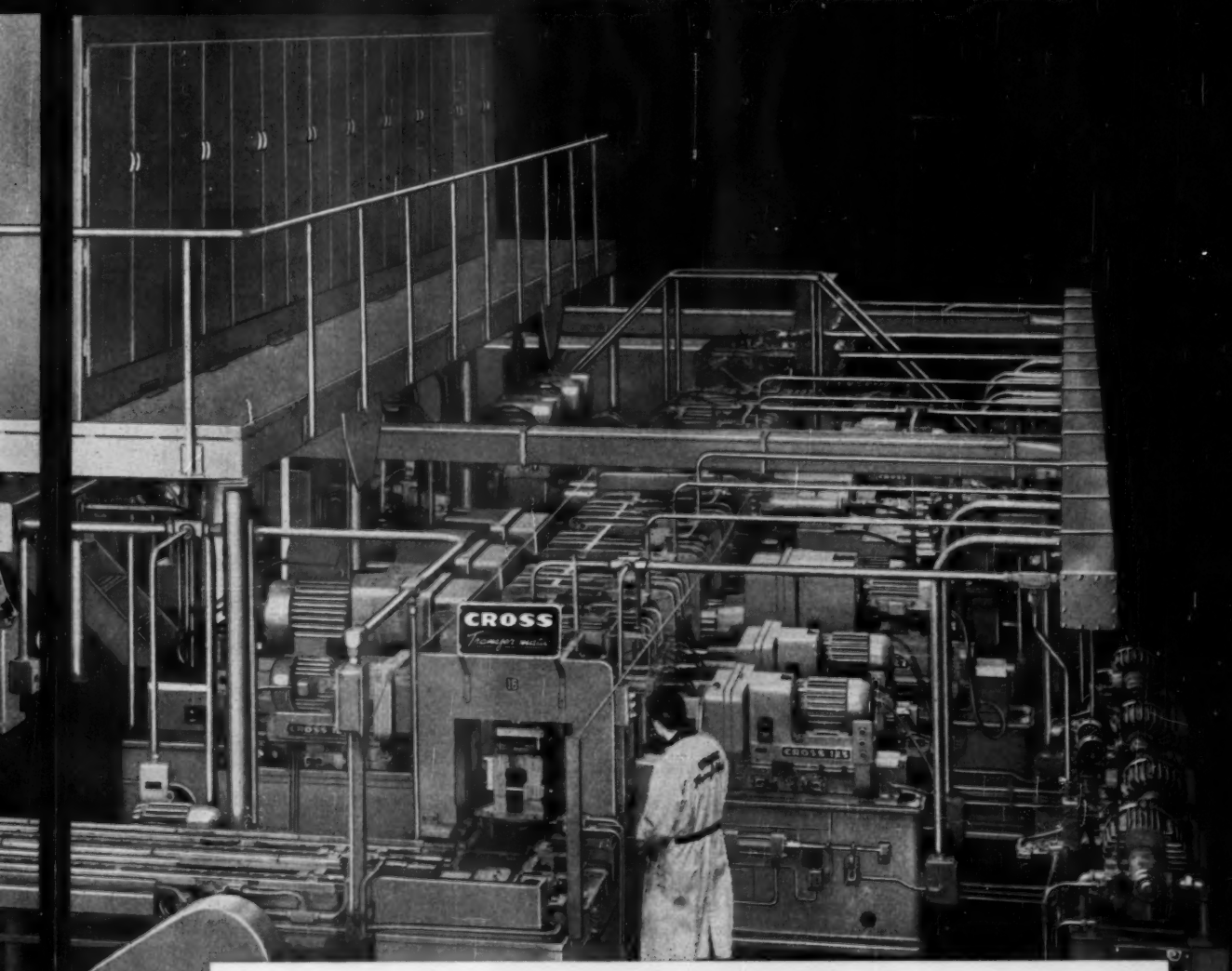
*Established 1898*

THE CROSS CO.

*First in Automation*

PARK GROVE STATION • DETROIT 5, MICHIGAN

# *Another Transfer-matic by Cross*




Here is another revolutionary development by Cross! A new Transfer-matic makes it possible to machine and inspect *one piece* rear axle differential gear cases—the first time such a part has been processed on a transfer machine.

Two cases are machined at a time as they travel a distance of 206 feet through 30 stations. Rated capacity is 212 pieces per hour at 100% efficiency. Operations include rough and finish forming the two spherical seats for the pinions; rough and finish boring and facing the two seats for the side gears; drilling, boring and reaming the pinion shaft hole; drilling and reaming the lock pin hole; drilling, chamfering, spotfacing and reaming the twelve ring gear mounting holes.

A unique feature is the arrangement for locating and clamping the pallet fixtures. In each station, elevators lift the fixtures from transfer bars into engagement with locating pins and stop buttons fixed in the overhead bridge structures. Individual wedges then back up the elevators to secure the pallets. After cutting, the elevators lower the pallets onto the transfer bars, which carry them to the next station.

Other features include construction to JIC Standards, hardened and ground ways, complete interchangeability of all standard and special parts, pre-set cutting tools and Cross Machine Control Units which program tool changes to reduce machine downtime.

Let's toss a bouquet to the modern super-market — one of the greatest time and trouble savers in present-day living.

But, have you ever stopped to think that, in the abrasives field, Norton brings you real super-market convenience? Here, in the world's largest line of abrasive products, is everything you need for every grinding job.

*Take tool room grinding wheels. In these, as in all other categories, the Norton line is 100% complete. You don't have to shop around — going to one source for wheels that will sharpen steel tools, to another for diamond wheels, to another for mounted wheels.*

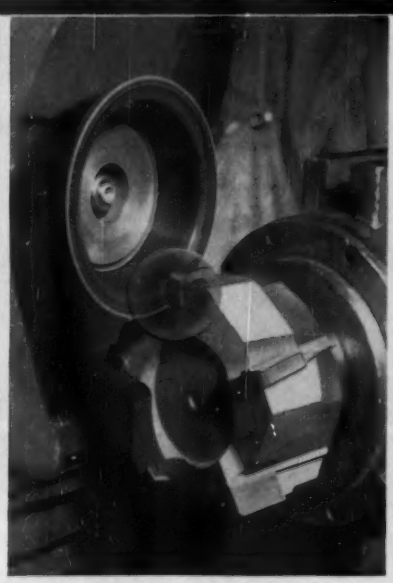
*You can get them all at Norton. And they're all the best wheels that can possibly be made. The advanced equipment and broad experience you find at Norton you'll find nowhere else in abrasives manufacture.*

Advantages like these mean leadership. And they result in precision-processed, precision-performing wheels that grind exactly alike — from wheel to wheel and lot to lot.

**See Your Norton Distributor** for wheels that will bring the value-adding, profit-boosting "Touch of Gold" to all your tool room grinding operations. Ask him for the two helpful booklets — *A Handbook on Tool Room Grinding* and a booklet on *How To Select Wheels For Precision Grinding Tool And Constructional Steels.* Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**

# TOOL ROOM GRINDING

**FOR SHARPENING STEEL TOOLS,** as well as for surface, cylindrical and internal grinding on all steels, Norton G Bond and BE Bond Wheels — in 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM or the new non-premium priced 44 ALUNDUM abrasive — add the money-saving, cost-cutting "Touch of Gold." These vitrified bonds are the most efficient ever developed for precision and semi-precision grinding.



**FOR CARBIDE GRINDING,** Norton diamond wheels are the recognized "Crown Jewels." Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding. For many carbide grinding jobs Norton K Bond CRYSTOLON* wheels are often the best investment.

**FOR DIE AND MOLD FINISHING** Norton mounted wheels bring you big savings on the widest range of tool room jobs. They're a 100% complete line, for all requirements.

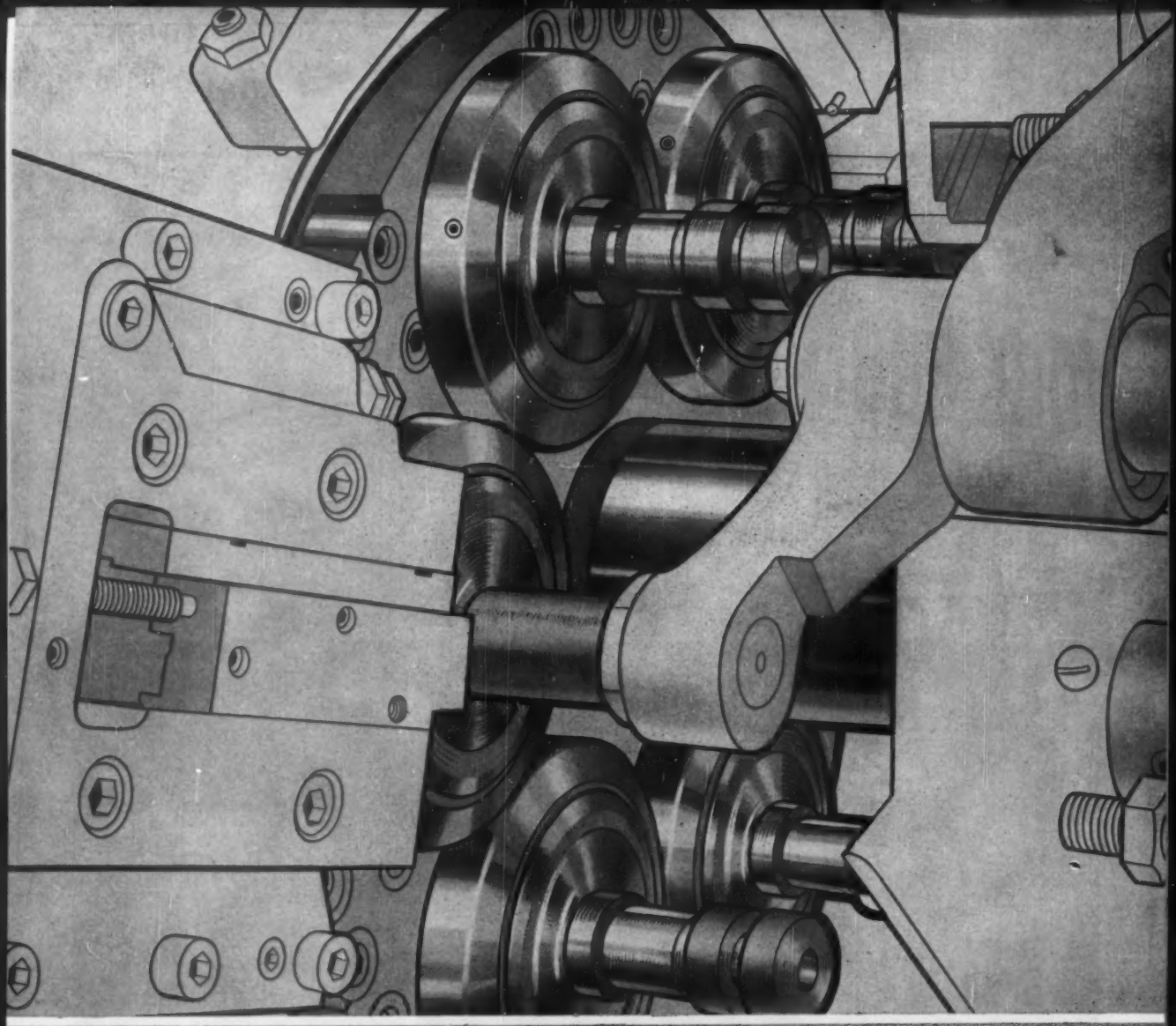
*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

*Making better products... to make your products better*

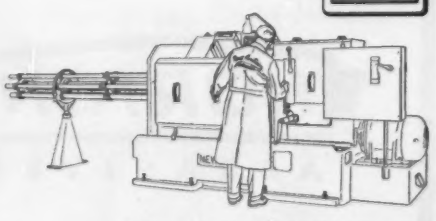
NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

W-1763

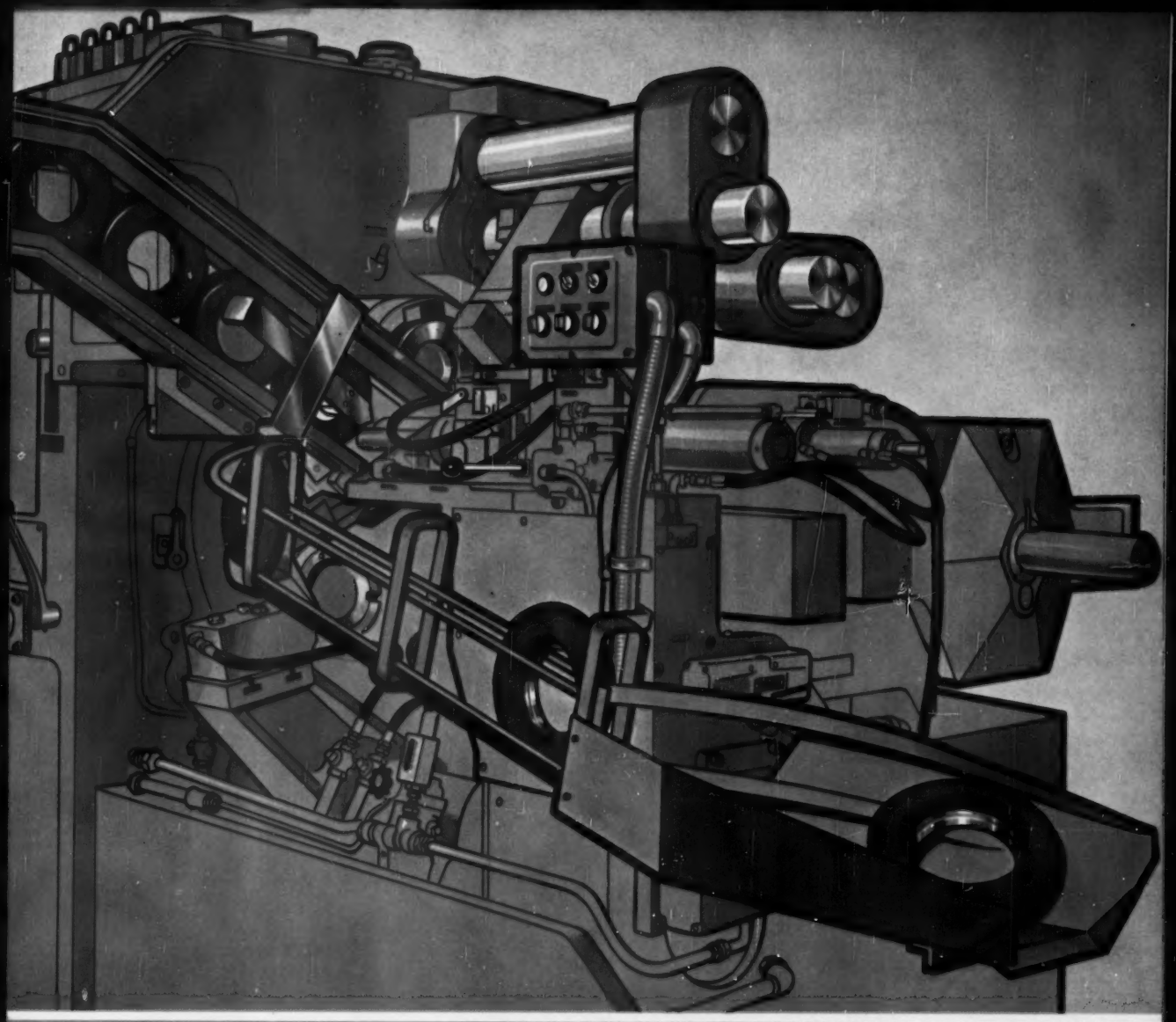


# get more bar work done with the widest range of spindle speeds

The New Britain Model 62, 2¼" automatic bar machine illustrated, has a spindle speed range of 117-3,000 R.P.M. No other multiple spindle bar machine in its capacity offers as wide a range of spindle speeds combined with New Britain standards of accuracy. Before you decide on *any* bar machine, be sure to check on *new* developments in New Britains. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



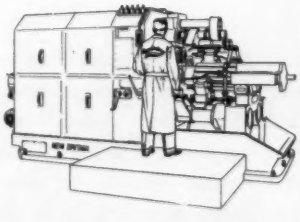
Automatic Bar Machine



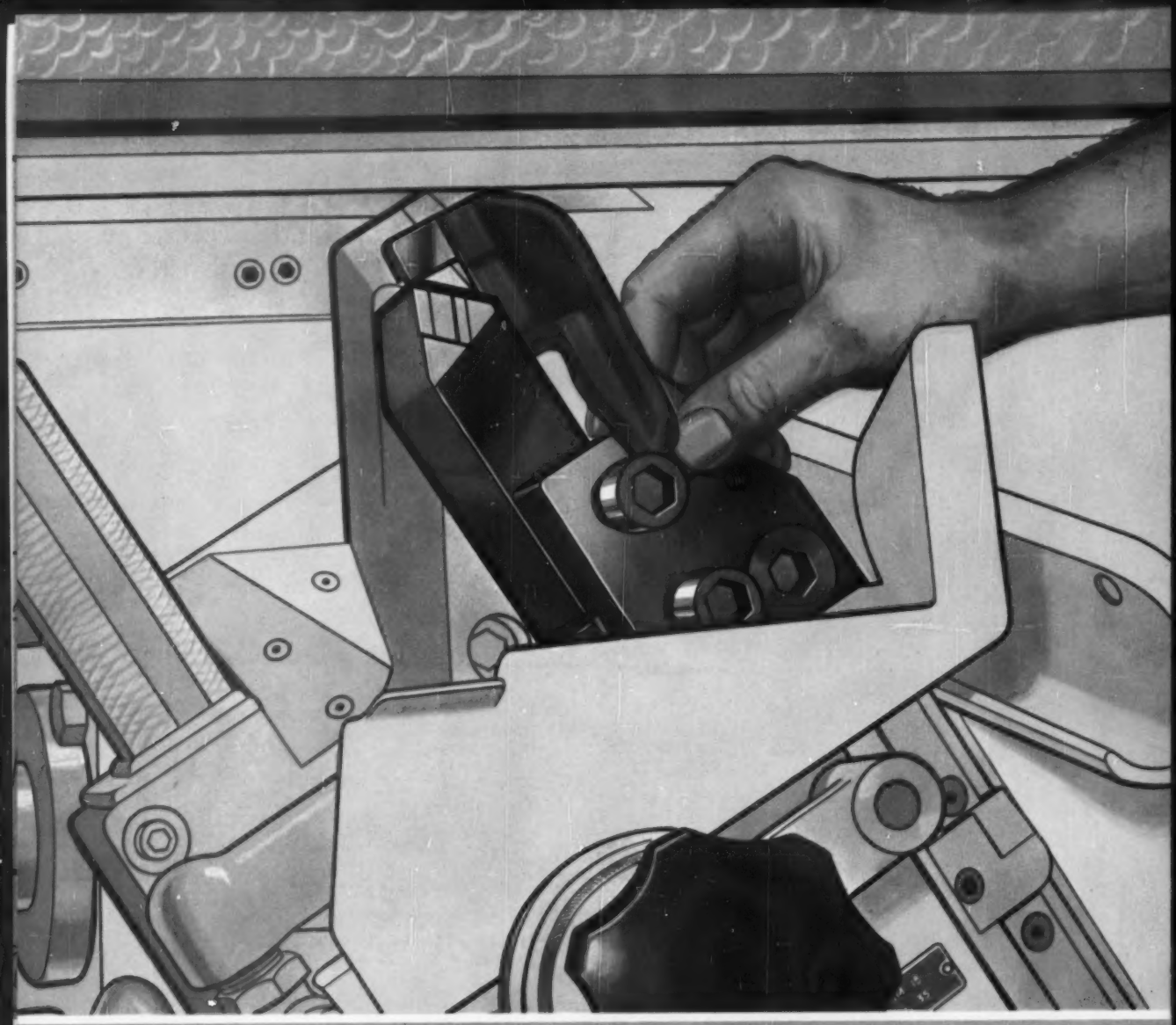
# get more chucker work done

## with automatic "handling"

New Britain chuckers are the time-tested leaders in their field. Their basic open-end design, an exclusive New Britain feature, makes them unusually well adapted to the automatic handling of pieces. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



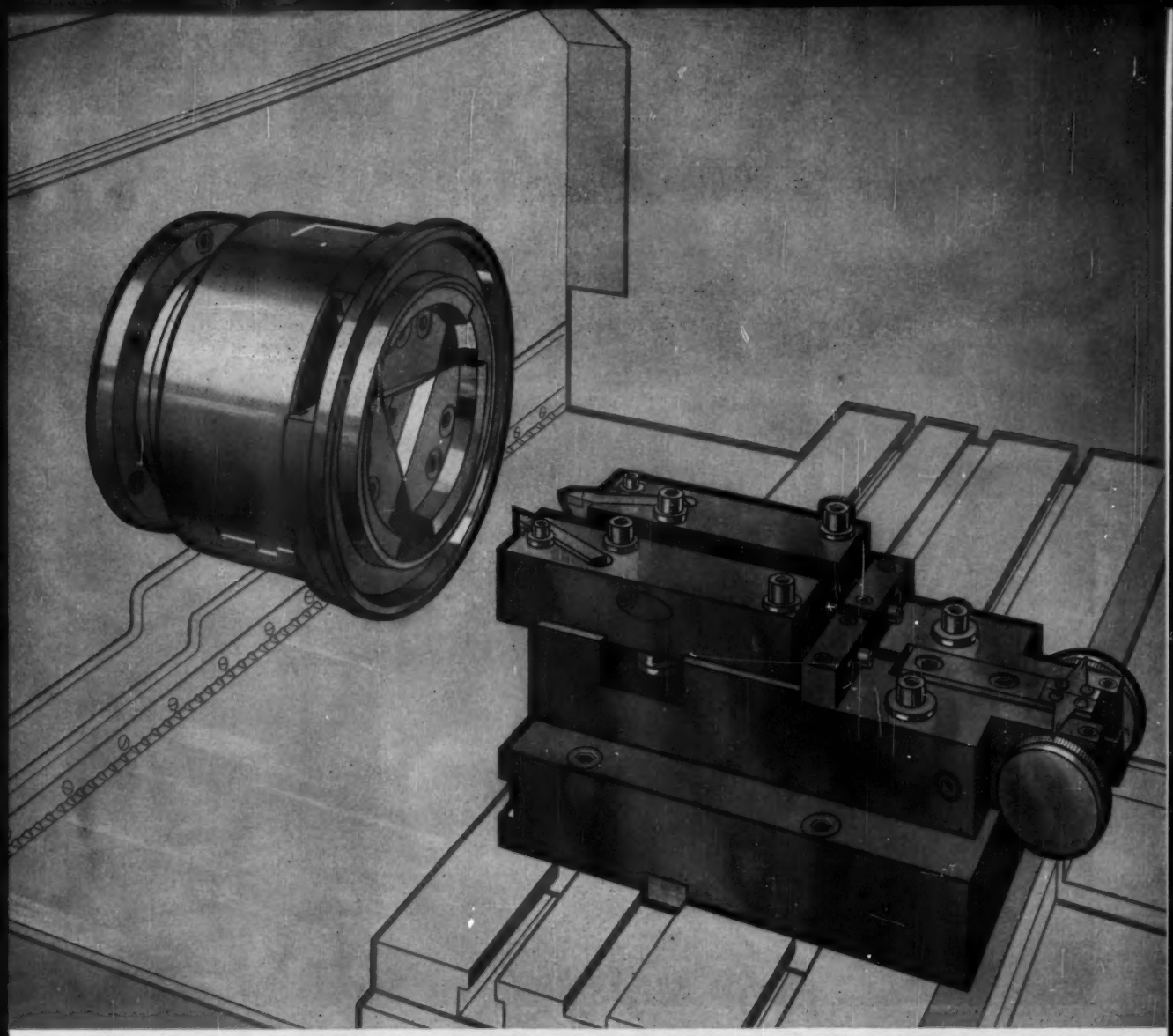
Automatic Chucking Machine



# 1-minute tool change gets more contour work done

It's a fact — you can do more work in a day with a New Britain +GF+ copying lathe and a single-point tool, than with a conventional lathe using half a dozen. Just slip out the worn tool, slip in a new one, gauge it to a single dimension and you're ready to go again. The template repeats the dimensions. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

New Britain +GF+ Copying Lathe

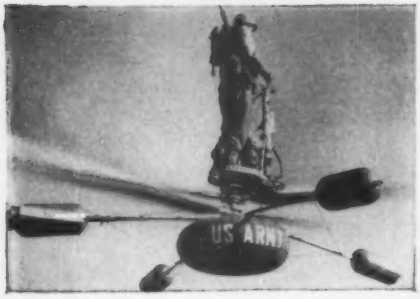


# closer tolerances because of cam control

# in New Britain precision boring machines

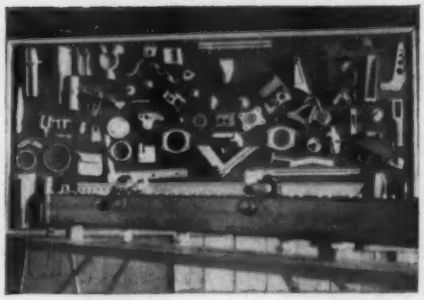
Every piece turned out by a New Britain Precision Boring Machine is accurate in every dimension because of the precision cams which control the slides. Tool wear can be checked by gauging a single dimension per tool of even the most complex contoured piece. There's no substitute for this positive uncomplicated dimensional control when you're working to "tenths." The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

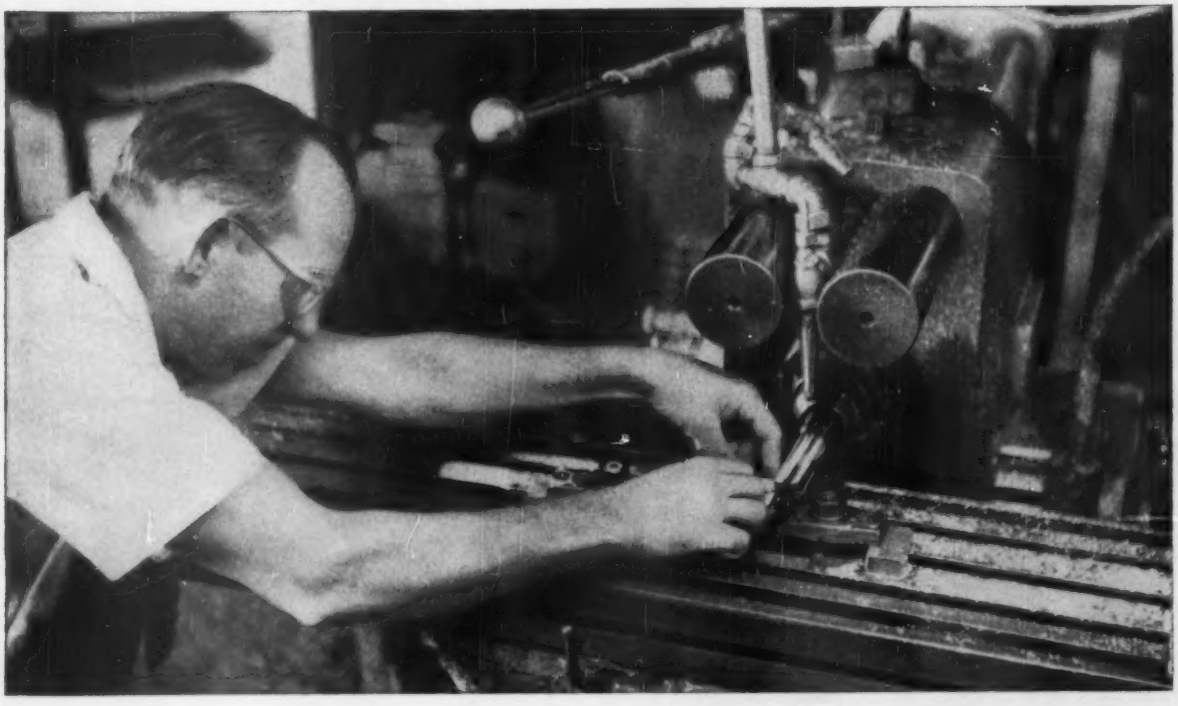
Precision Boring Machine




◀ **Aerocycle,** a one-man helicopter now being tested by the U. S. Army, is one of the many aircraft for which Aeroaffiliates machines precision parts.

**Some Examples of Aeroaffiliates' Work.** ▶ All require fine tolerances and excellent finish. All were made with the help of Cities Service Chillo Cutting Oils.





# "Fine Tolerances! Excellent Tool Life! With Cities Service Chillo Cutting Oil"

In probably no other machining operation are the tolerances so fine, the requirements so demanding as in aircraft work . . . especially when it's for the U. S. Army or Air Force.

But it is on such work that Aeroaffiliates, Inc. of Fort Worth, Texas, has become famous.

Every day, Aeroaffiliates employees must work with tolerances as fine as .0001, and their products must have an unusually good finish . . . so good that they are measured by a special gauge before the aircraft industry will accept them.

Obviously, this could play havoc with tool life . . ."but thanks to Cities Service Chillo Cutting Oils, tool life and finish are the best ever," says Aeroaffiliates. "These cutting oils are equalled only by the help we receive from the Cities Service Lubrication Engineer, a man whose knowledge and help we greatly value."

Whatever *your* type of machining operation, there's a Cities Service cutting oil tailored precisely for it . . . and a Cities Service Lubrication Engineer to help you choose it. Call him in this week. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

**CITIES SERVICE**

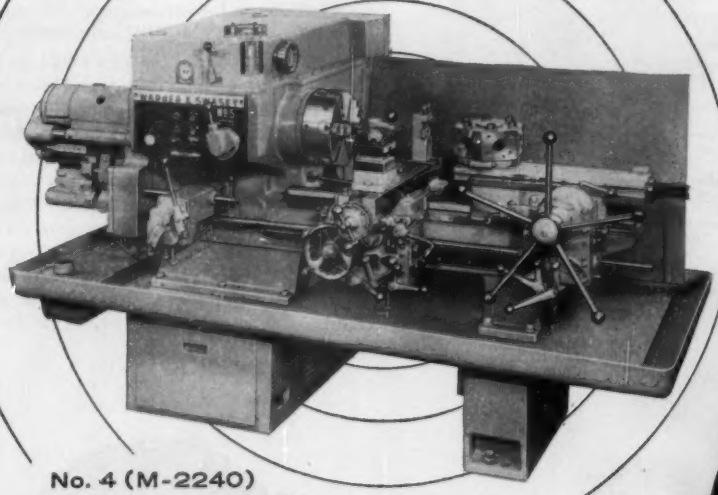
**QUALITY PETROLEUM PRODUCTS**

**On new Warner & Swasey No. 4 and No. 5 Turret Lathes with new all-hydraulic headstock...**

**YOU CAN CHANGE SPEEDS**

**FASTER THAN YOU CAN**

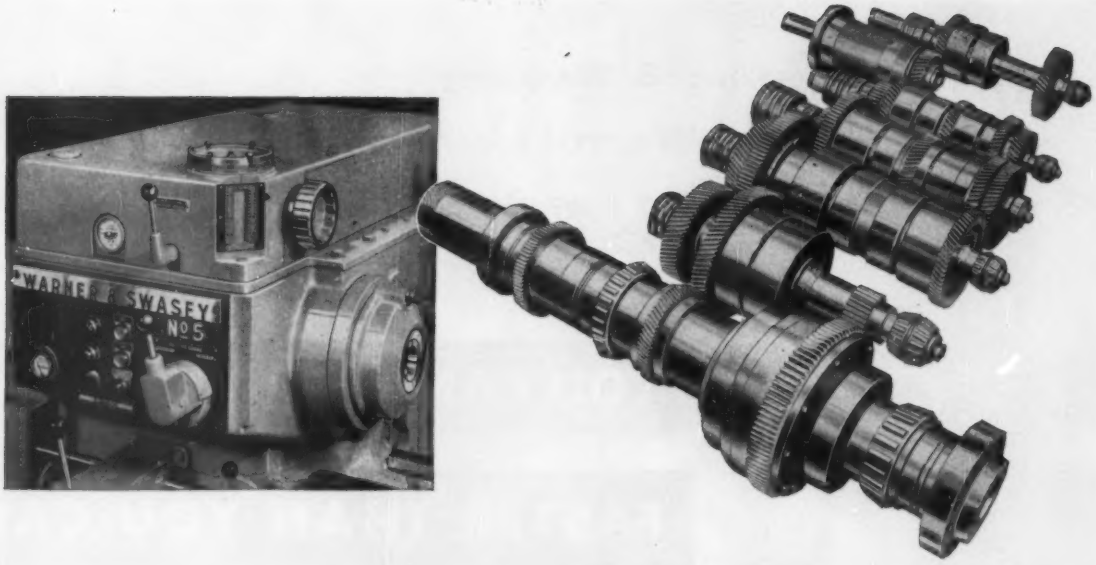
**TURN THIS PAGE!**



**No. 4 (M-2240)**
2" Bar Capacity—18¼" Swing

**No. 5 (M-2250)**
2½" Bar Capacity—20" Swing

WARNER & SWASEY
*Cleveland*
PRECISION MACHINERY SINCE 1880




# INSTANTANEOUS SPEED CHANGES

# WITH THE FLIP OF A LEVER

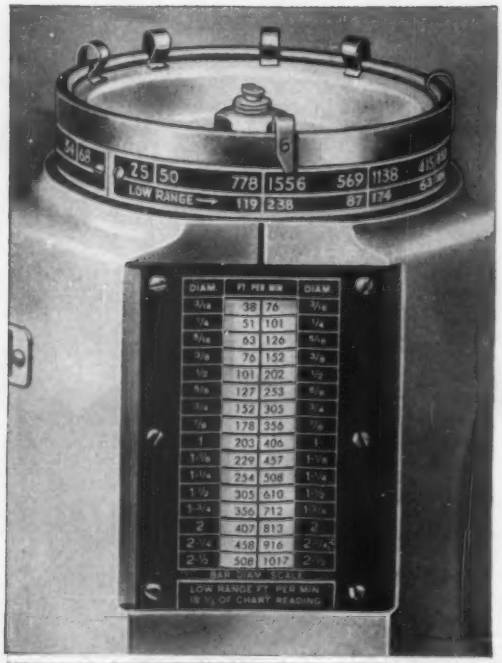
DIRECT-ACTING hydraulic clutches, with a constant-mesh gear train, eliminate all gear shifting on these new Warner & Swasey Ram Type Turret Lathes. Clutches engage smoothly and quickly, providing fast starts, stops, and reverses. Clutches never need adjustment.

With the patented speed preselector the operator can preselect speeds and with a mere flip of a lever, change speeds instantly.

A flip of the speed change lever in the opposite direction provides a valuable 6 to 1 speed reduction for threading or forming cuts —instantly and without preselection.

A total of 12 spindle speeds, or 24 unduplicated speeds with a two-speed motor, are available on these new machines. A touch of a button doubles or halves the speed, and when used in conjunction with the 6 to 1 speed change, four spindle speeds are instantly available with only one setting of the preselector.

A separate master lever controls forward, reverse, brake and neutral. *Zoned controls* on headstock and apron put them all within easy reach of the operator—cutting fatigue, speeding his work, putting more pieces on the floor every hour of every day!

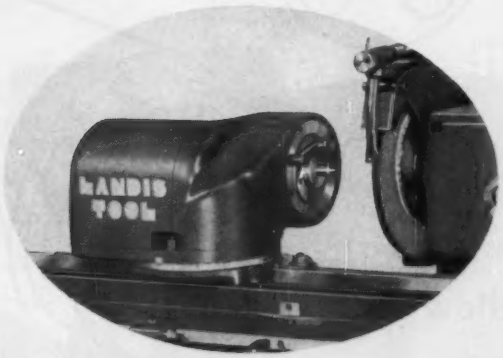



*Warner & Swasey's direct-reading, patented speed preselector is calibrated in work diameter, surface feet, and spindle rpm's—which, with the new ease of changing speeds, encourages the operator to use the proper spindle speed.*

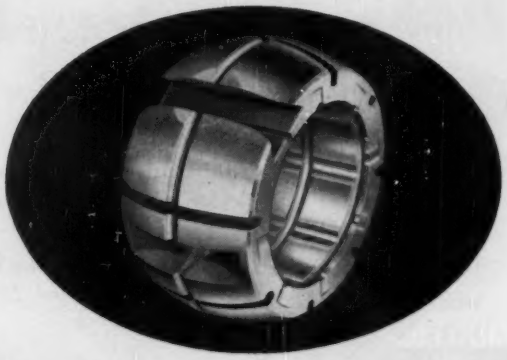
WARNER & SWASEY
*Cleveland*
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

# Low cost general purpose grinder with 2 exclusive "big grinder" features...




**Variable speed headstock**... compact design with only two revolving parts. Can be swiveled for angle or face grinding.

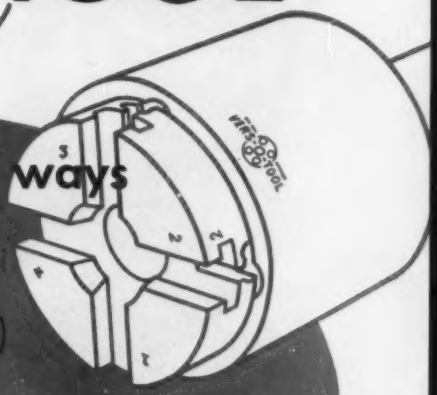


**Microsphere bearings**... close running clearance of Landis Microsphere spindle bearings gives faster spark-out, accurate, quick response to wheel feed.

LANDIS 12" x 28" Grindwell Universal ... compact, precision grinder for manufacturing, maintenance, toolroom and training.

**LANDIS**
precision grinders
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

# Namco VERS-O-TOOL



## lets you use the same head – two ways

- with chasers . . . (for threading)
- with cutters . . . (for hollow milling)

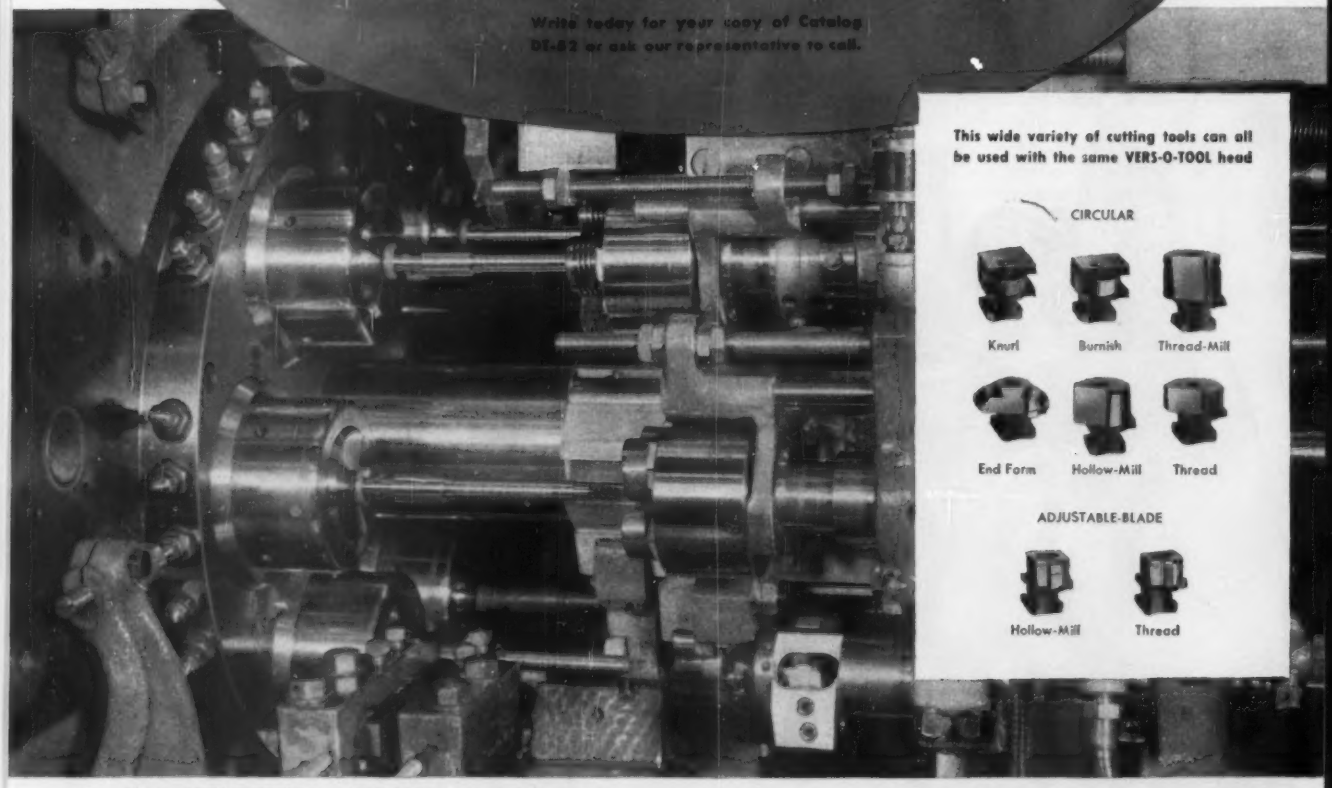
**CIRCULAR CUTTING TOOLS** reduce costs and speed production on threading jobs, and forming and turning.

**GROUND THREAD CHASERS** provide more threads per grind—and you can regrind to a full 270° of chaser circumference.

**BASIC DESIGN SIMPLICITY**— fewer moving parts —insures long, trouble-free performance.

**NAMCO CHASER GRINDING SYSTEM** permits cutter senings to be made in the toolroom without head adjustments—no need for trial error run after sharpening.

Write today for your copy of Catalog DE-62 or ask our representative to call.



**This wide variety of cutting tools can all be used with the same VERS-O-TOOL head**

CIRCULAR



Knurl Burnish Thread-Mill



End Form Hollow-Mill Thread

ADJUSTABLE-BLADE



Hollow-Mill Thread

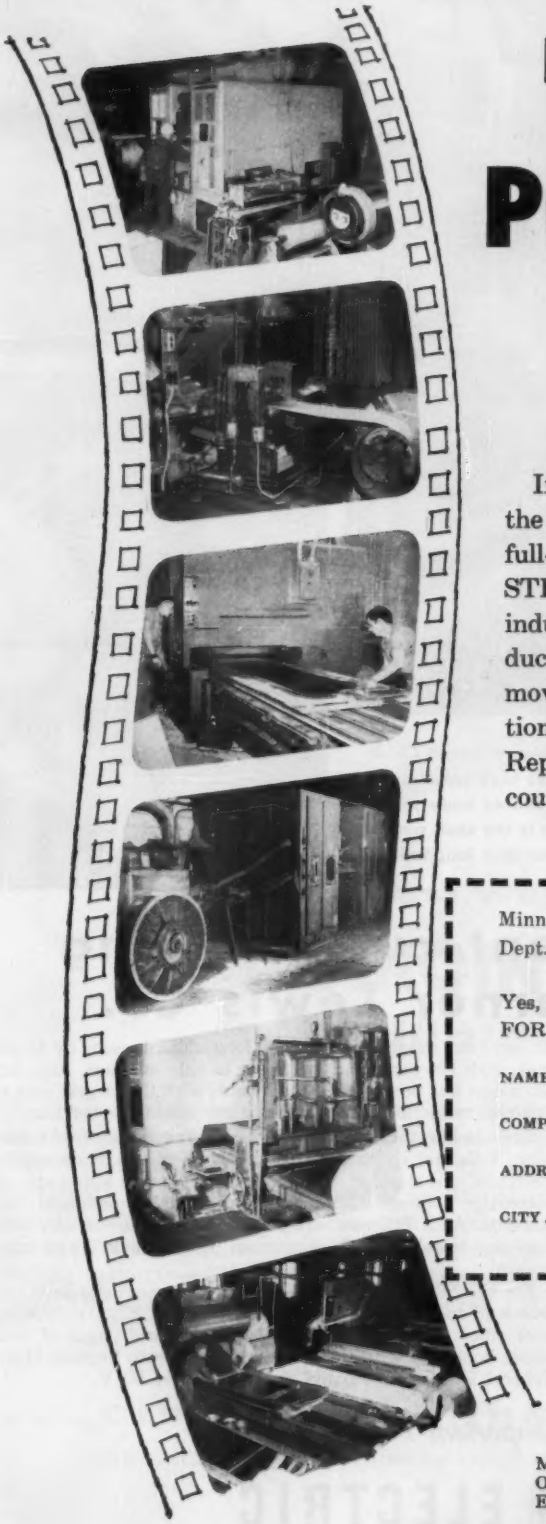
**Three Namco VERS-O-TOOLS, on this 1¼" RA-6 Acme-Gridley Bar Automatic, hollow mill the stem and cut 2 thread diameters on cast bronze valve stem.**

# National Acme

**THE NATIONAL ACME COMPANY, 171 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.**

# Announcing an important new motion picture for

# Primary Metal Industries



If you manufacture, process or fabricate *any* of the primary metals, you'll want to see the brand new full-color sound movie, "A CHALLENGE FOR STEEL", prepared especially for the primary metals industry by the 3M Company—world's largest producer of industrial coated abrasives. You'll find this movie packed with cost-saving tips, helpful information about coated abrasives. Contact your 3M Representative today for a free showing. Or send coupon below.

Minnesota Mining and Manufacturing Co.
Dept. AK-57, St. Paul , Minnesota

Yes, I want to see your primary metal movie "A CHALLENGE FOR STEEL". Have a 3M Representative contact me right away

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Made in U.S.A. by MINNESOTA MINING AND MFG. CO. General Offices: St. Paul 6, Minn. In Canada: P.O. Box 757, London, Ontario. Export Sales Office: 99 Park Avenue, New York City.

**D. L. Walker welds a circular seam with Fillerarc* equipment at Warner Lewis Co. in Tulsa, Okla. Says weldor Walker: "This Fillerarc welder is tops! Its high speed gives greater penetration, smoother flow-out. It's easy to operate and reduces body strain. And it's very flexible for reaching hard-to-get-at places." At right is the shell part of one of the filter-separators Warner Lewis makes, showing circular and longitudinal seam welds made with fast, flux-free Fillerarc equipment.**

# Fillerarc* equipment cuts welding time 50% at Warner Lewis Co.

Warner Lewis Company, a division of Fram Corp. in Tulsa, Okla., has cut welding time 50 per cent while trimming labor costs more than 20 per cent by using General Electric automatic Fillerarc equipment in the production of filter-separators for refueling trucks.

The tanks are made of an alloy of copper with 7½ per cent aluminum, 2½ per cent iron, and a trace of manganese. As a shielding gas for the Fillerarc process, Warner Lewis uses a mixture of 65 per cent helium and 35 per cent argon. Welding both circular and longitudinal seams, the General Electric automatic Fillerarc welder was selected because previous equipment could not handle the production volume involved.

Just how well Fillerarc has done the job is shown in this comment by K. Wayne Cosan, production manager: "Since materials and design are fixed by exacting specifications, the only way to reduce costs is to increase production. With General Electric Fillerarc equipment in our automated setup, we have cut welding time on the longitudinal seams by 50 per cent, with 100 per cent penetration in only one pass. Also, our labor cost has been cut 21½ per cent, with the largest part of this cost reduction attributable to our automatic welding."

Savings like these are typical of the results being obtained with Fillerarc equipment, General Electric's consumable-electrode, gas-shielded process for either semi-automatic or automatic welding. Fillerarc welding is fast, economical, and flux-free. And, Fillerarc equipment is versatile—it can weld mild and stainless steel, aluminum, bronze, nickel, and magnesium.

For the full story of how Fillerarc equipment can save you time and money, call your nearby General Electric welding sales office or distributor (listed in the yellow pages of your phone book), or write for more information to Section 713-7, General Electric Company, Schenectady 5, N. Y.

*Registered trade-mark of the General Electric Co.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

With this Cincinnati 18″ Royal Six-Spindle Drill, two operators achieve a high output of secondary work on small metal components for The Mall Tool Co. in Chicago. Operations include drilling, tapping, counterboring and countersinking. Four of the six spindles are equipped with Cincinnati's new geared power feeds—.002″, .005″, .009″, or .015″ per spindle revolution.

## low cost way to high production

# CINCINNATI ROYAL

## Multiple-Spindle Drills

Here's how you can make production really *move* on sequence drilling operations—and keep your drilling machine investment *low*. Install new Cincinnati Royal Multiple-Spindle Drills. They have the high accuracy, speed range and work area you need to accomplish a wide variety of precision drilling operations. All-new, Cincinnati-engineered Royal Drills are available in 16″ and 18″ sizes, 1, 2, 3, 4 or 6 spindles, with drilling capacities in cast iron of $\frac{5}{8}$″ and 1″ respectively. They're *metal-working* drills, built by machine tool builders to machine tool standards. Investigate their many fine construction features . . . their economical price. See the CL&T dealer in your area. For catalog data, write Cincinnati Lathe and Tool Co., 3207 Disney St., Cincinnati 9, Ohio.

center on **cincinnati lathes and drills**

Builders of Engine, Toolroom, and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

# ARMSTRONG

## SET-UP AND HOLD-DOWN TOOLS

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

*Write for Circular*

Buy ARMSTRONG TOOLS from your Industrial Distributor

T-SLOT CLAMP

NON-SKID BLOCK

PLANER JACKS

STEP BLOCK

UNIVERSAL CLAMP

T-SLOT BOLTS AND NUTS

STRAP CLAMPS

**ARMSTRONG BROS. TOOL CO.**

"The Tool Holder People"

5215 W. ARMSTRONG AVE. CHICAGO 30, U. S. A.

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# "What's NEW!

with SIMONDS ABRASIVE CO.

GRINDING WHEELS

NEW

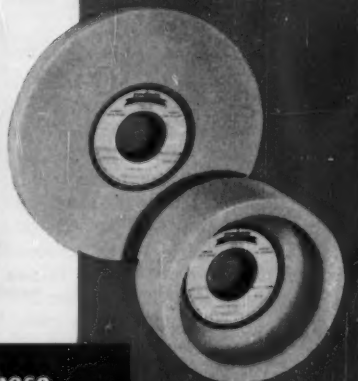
## IL BOND ... for longer, faster, heavy-duty grinding

New IL Bond . . . it's in the grinding wheel mix. Special chemicals and compounds added to conventional resinoid bonds provide an *internal lubricant* to increase cutting action and prolong grinding wheel life. For ALL your snagging jobs!

NEW

## DA Borolon® TRADE MARK ... abrasive for resinoid bonded snagging wheels

New DA Borolon . . . an improved, smaller crystal aluminum oxide abrasive for resinoid snagging wheels for floor stand and swing frame grinders . . . has more and sharper cutting edges, gives more production. Use with IL Bond described above.



NEW

## SA Borolon® TRADE MARK ... abrasive for toolroom grinding wheels

New SA Borolon . . . a radically different, friable aluminum oxide abrasive with a unique *single* crystal formation that gives cooler, faster grinding and longer life. Ideal for tool and cutter grinding and horizontal surface grinding.

*Send for descriptive catalog bulletins on these new products. Ask for IL, DA or SA bulletins.*

**SIMONDS ABRASIVE COMPANY**

Tacony & Fraley Sts., Philadelphia 37, Pa.

*DIVISION OF SIMONDS SAW AND STEEL CO.*

BRANCHES: PHILADELPHIA • CHICAGO • DETROIT • LOS ANGELES
SAN FRANCISCO • PORTLAND, ORE.

CALL YOUR SIMONDS DISTRIBUTOR

LOCAL STOCK
FAST SERVICE

# VK

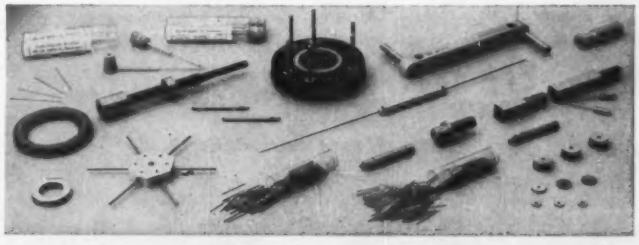
# USE OUR SKILLS on YOUR LAPPING PROBLEMS

*If that tough production part has Gage Characteristics, try the Van Keuren Precision Lapping Service--*

The Van Keuren Co. laps optical flats to an accuracy of .000001", gage blocks to .000004", plug gages to .000010". Your job may not be this precise, but it's a safe bet that VK skills can save you money on lapping problems involving size, flatness, parallelism or fine surface finish. If that tough production part has at least one gage characteristic, ask for a quotation from VK.

We lap flat and cylindrical work in both metals and nonmetals. Sealing rings and plates for pumps and pressure devices, precision pins, spacers, pistons, punches, ***carbide pivots,*** valve parts, instrument components and parts for testing inspection equipment, are among the customer items handled economically here in our plant.

If you require lapped or polished surface finishes in the order of .5 to 5.0 RMS, or dimensional tolerances from .000001" to .0001", The Van Keuren Co. can probably help on the problem. The "rule of thumb", as suggested above, is "at least one gage characteristic."



Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

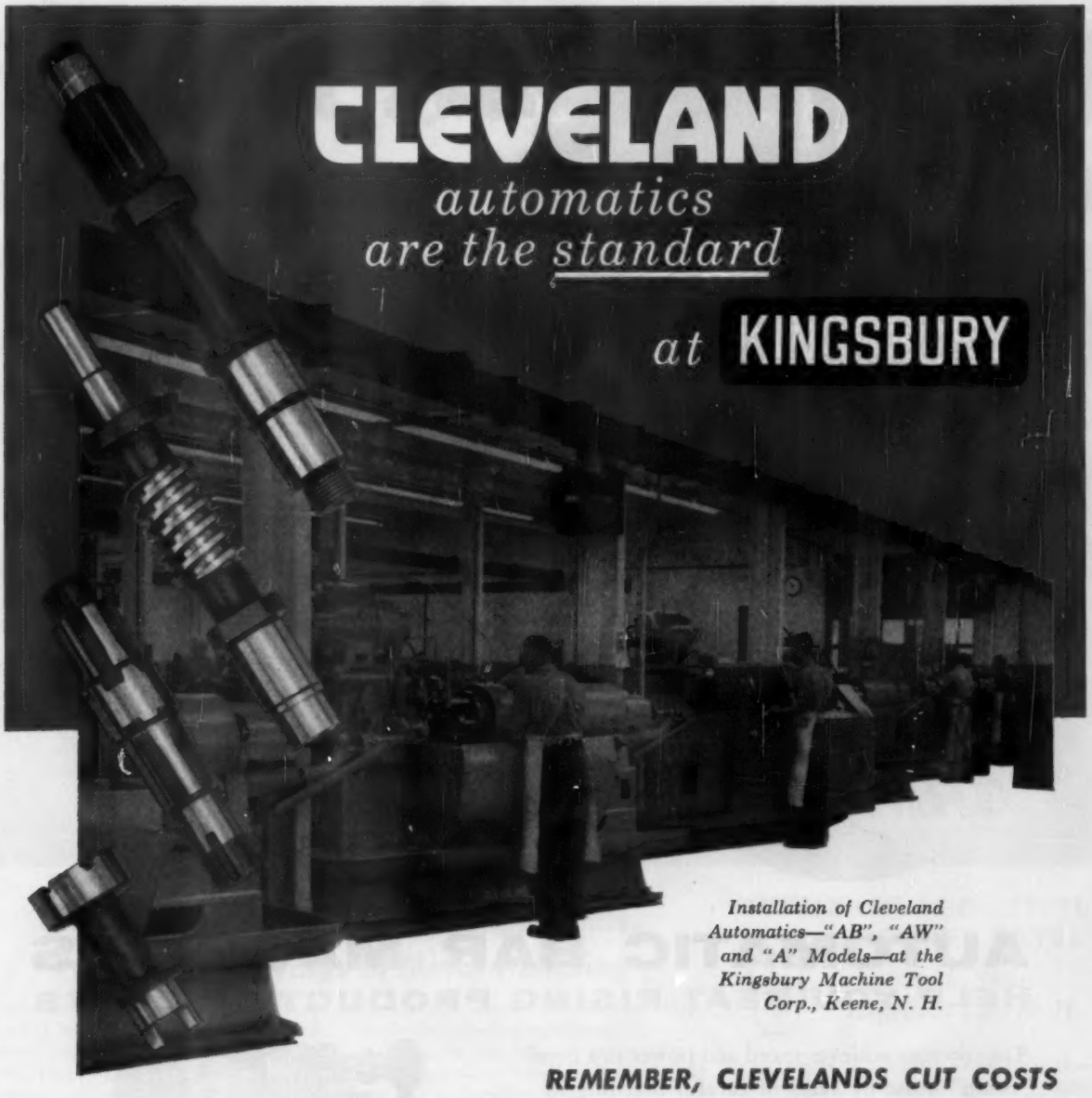
VK

38th YEAR

THE Van Keuren CO.,

**173 WALTHAM STREET, WATERTOWN, MASS.**

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.




*Installation of Cleveland Automatics—"AB", "AW" and "A" Models—at the Kingsbury Machine Tool Corp., Keene, N. H.*

## REMEMBER, CLEVELANDS CUT COSTS

The Kingsbury Machine Tool Corp., Keene, N. H., has *standardized* on Cleveland Single Spindle Automatics for their screw machine department. The Clevelands are used to blank out many of the component parts for the high production indexing automatic drilling and tapping machines which they build. Shown above are four finished parts which were originally blanked on Clevelands. Many other parts are machined complete on Clevelands.

Clevelands were selected for this work because they combine a wide range of multiple-tooled operations with quick set-up and easy control. These Cleveland qualities assure fast, accurate and low-cost production on both long and short runs.

If you produce any parts requiring turning, forming and end-working operations, you'll profit by giving Clevelands a full investigation. Call in a Cleveland sales engineer . . . or let us submit recommendations with production and cost estimates based on part samples or prints of your work. There is no obligation. For machine specifications, write for new General Bulletin describing the line of Clevelands.

**THE CLEVELAND AUTOMATIC MACHINE COMPANY**

**4928 Beech Street**
**Cincinnati 12, Ohio**

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CLEVELAND • DETROIT
HARTFORD • S. ORANGE

**Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines**

PRODUCTION MACHINERY

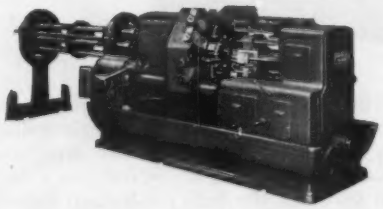
GREENLEE

# AUTOMATIC BAR MACHINES

## HELP YOU BEAT RISING PRODUCTION COSTS

The cowman achieves speed and power in a good "using" horse by years of careful breeding . . . Greenlee develops these same qualities in its Bar Automatics by continuous research and design improvement. One of the many superiorities of this speed and power is that it enables you to take full advantage of modern tooling practices. Your Greenlee representative will be glad to show you how it is done. Please submit print when inquiring about a specific job.

***Write for Catalog No. A-405***



**SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES**

**GREENLEE Special Machine Tools**

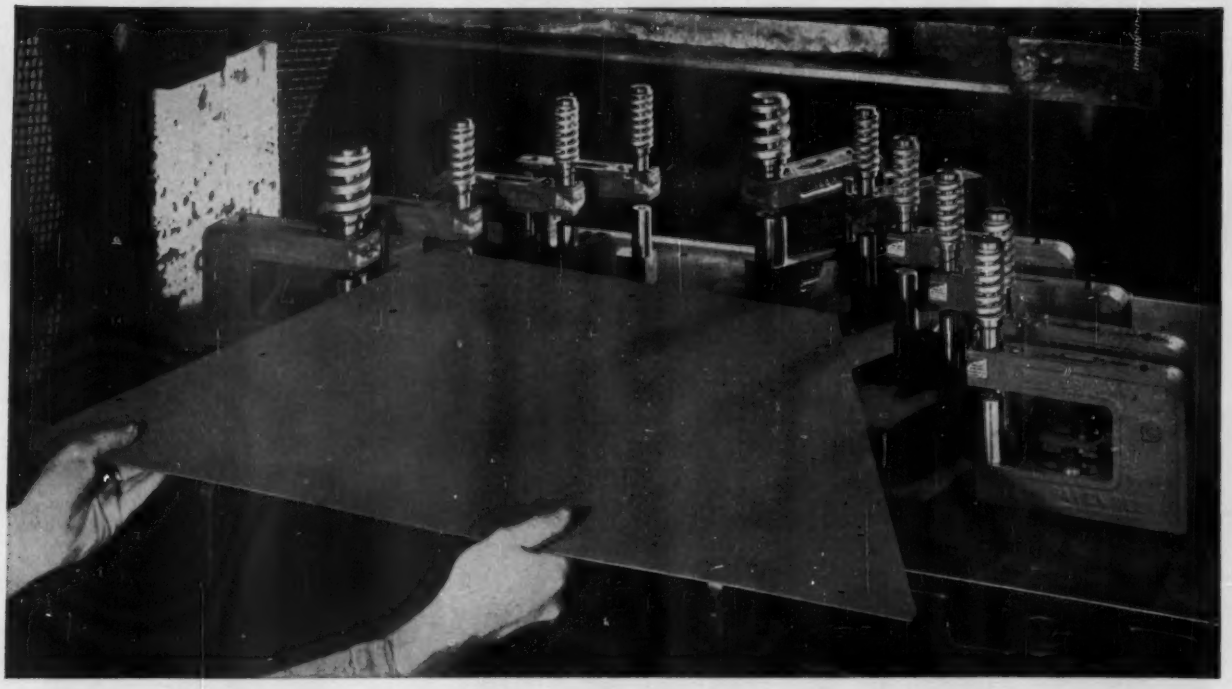
- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

**GREENLEE BROS. & CO.**

**1725 MASON AVE.**
**ROCKFORD, ILL.**

# Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

## Omega Punches, Used in Multiple Units, Provide Big Savings in Metal Punching

If you'd like to see some interesting metal-punching jobs, the place to visit is Wales-Strippit Company, at North Tonawanda, N. Y. There they employ about every punching operation imaginable, using self-contained punching units which are set up quickly to meet the requirements for varied hole sizes or shapes.

One of the tool steel grades which has been doing a fine job of minimizing shop costs at Wales-Strippit Company is Bethlehem Omega, a super-tough steel supplied by Leed Steel Co., Buffalo. Omega's dependability and long service life have been remarkable . . . all the more so because it is used exclusively in punching hard metals, where high shock-resistance heads the list of requirements.

Omega is our "super" grade of oil-hardening, shock-resisting tool steel. It can also be quenched in water. Here's its typical analysis:

| C | Mn | Si | Mo | Va |
|---|---|---|---|---|
| 0.60 | 0.70 | 1.85 | 0.45 | 0.25 |

Omega isn't limited to service in punches, either. It's just what the doctor ordered for hand and pneumatic chipping chisels, knockout pins, swaging dies, shear blades, and other uses where the steel is continually subjected to severe shock.

## Making Plastic Parts? Use Lustre-Die

Lustre-Die, our new plastic-molding tool steel, is really something! What a high polish it takes! And what high lustre you get on the finished parts! Lustre-Die has a well-balanced analysis, and is alloy fortified to increase its depth of hardenability and mechanical properties. It's good steel. You'll like it.

## BETHLEHEM TOOL STEEL ENGINEER SAYS:

### *Oxide Skin Improves Lehigh H*

Most users of hot-work steels know that the oxide skin, put on the surface of tools by the second temper, is beneficial. This oxide coating serves partly as a lubricant, and also helps conventional lubricants to adhere, thus increasing wear-resistance.

When tempers above 900 F are used, Lehigh H tool steel is also benefited in the same way by the oxide coating resulting from the second temper. Here is the sequence of operations to be followed in heat-treating Lehigh H, so as to take advantage of the oxide coating:

1. Heat the tool and quench it in the conventional manner.
2. Temper at 925 F (or higher for some purposes).
3. Grind the tool to size, and remove scale and decarburization.
4. Retemper the tool at 900 F. Do not grind or remove the light oxide coating—use the tool with this surface.

## The ONLY Turret Lathe with a fully automatic thread-chasing cycle!

Here is full turret lathe versatility and a threading attachment with a fully automatic cycle — all in one machine. Now you can be sure of concentricity of threading with other lathe work, *all done in one chucking*, with the time saving of the Auto-Threader! Nowhere else in the world can this be found on a turret lathe.

This Auto-Threader will chase straight or taper threads — or a combination — internal or external, from the front of the machine.

Concerning this J&L development, a customer writes: "We are tripling production on many of our items."

Write for descriptive folder No. 5440. JONES & LAMSON MACHINE COMPANY, 502 Clinton Street, Springfield, Vermont.

**JONES & LAMSON TURRET LATHES**

the man who needs a new machine tool is already paying for it

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools — Thread & Form Grinders

**IMPORTANT:** For your convenience this sheet is perforated. Tear it out and "buck-slip" it to the proper man in your plant.

**Centerless Grinding Wheels** and Regulating Wheels by Carborundum are job-engineered. The *right* combination of abrasive grain and bond assures top operating efficiency. A typical centerless grinding sequence is reported on the back of this page. Compare these figures with yours.

*Ask the man from* **CARBORUNDUM** REGISTERED TRADE MARK **BONDED ABRASIVES DIVISION**

*Also makers of a complete line of Coated Abrasives and Abrasive Grain*

**ATTENTION GRINDING FOREMAN:** Turn the page and study the Product Performance Report written especially for you.

PRINTED IN U.S.A. 7B6

# *Product Performance Report*

## HYDRAULIC VALVE LIFTER BODIES

Millions of valve lifter bodies are required annually for the automotive industry. These precisely ground and finished parts are produced at rates as high as 3500 pieces/hr./machine. To produce these parts, which are finished to a size tolerance of .0003", wheels and machines must be right. Stock removal rates run the gamut, from .025"/pass and better in the roughing cuts to .0005"/pass in the finishing passes. Wheels must furnish maximum number of pieces per dressing and produce high quality work to close limits. A typical centerless grinding sequence for grinding valve lifter bodies before machining and heat treating follows:

Pass #1 24 x 6 x 12 WC465-P4-VD
14 x 6 x 5 A60-R2-R
Stock removal = .004 -.032"

Pass #2 Same wheels
Stock removal = .024"

Pass #3 24 x 6 x 12 A60-N5-V10
14 x 6 x 5 A80-R2-R
Stock removal = .015"

Pass #4 20 x 6 x 12 A60-N5-V10
12 x 6 x 5 A80-R2-R
Stock removal = .003"

**PROVE IT YOURSELF.** You can get the ***exact*** results you want in centerless grinding . . . in precision, rate of cut, and output. A complete survey of your operations will show you the specific grinding and regulating wheels you need.

**NOTE:** Carborundum, leader in abrasive techniques, backs up its products with trained sales representatives, a staff of competent field engineers and an abrasive engineering laboratory . . . all available to you to put more sense in your abrasive dollar.

Here is another in the series of Product Performance Reports being released by the Bonded Abrasives Division of The Carborundum Company. A color photograph of this actual operation is shown on the back of this page.

• *Ask your local distributor . . . or the man from*

**CARBORUNDUM**
REGISTERED TRADE MARK

786 PRINTED IN U.S.A.

*Stainless Steel*
*cutting information . . .*

# *Don't dawdle when sawing

SOME MACHINISTS (the slow, careful type that are so hard to find) like to saw metal very slowly. These men remember old instructions about overheating the blade or the metal, and they worry about destroying the "temper."

Not so with the austenitic grades of Stainless Steel (like the 300 series). These steels harden when they are worked. If you dawdle when sawing one of these steels, it will harden right ahead of the blade, and you'll swear the saw blade has lost its teeth.

All this talk leads to the simple suggestion: When sawing Stainless Steel, use the recommended speed and cut boldly, without dawdling. It will save time, tempers and saw blades.

Stainless Steel fabrication is not difficult, but it *is* different. So why not have the last word in fabrication techniques right in your desk? Write on your company letterhead for a copy of our 130-page "Stainless Steel Fabrication Book." Address United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

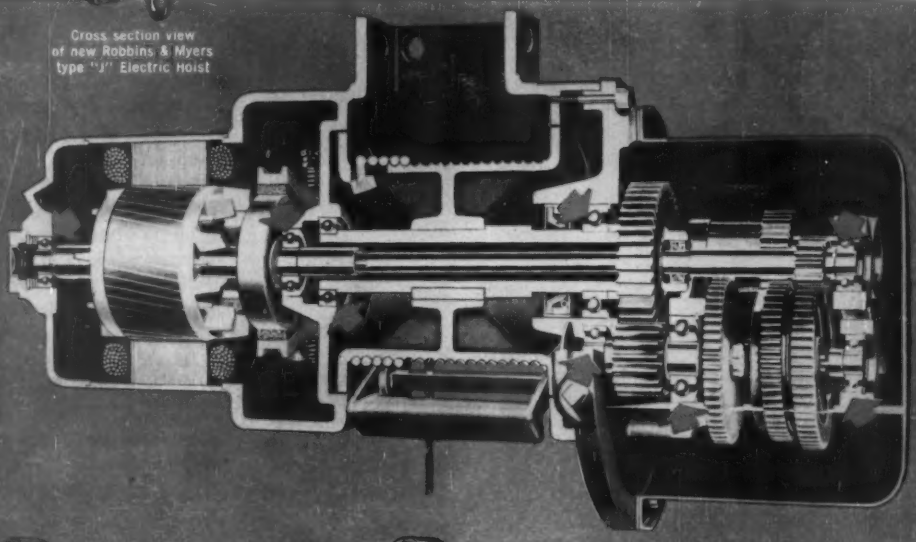
**USS STAINLESS STEEL**

SHEETS · STRIP · PLATES · BARS · BILLETS
PIPE · TUBES · WIRE · SPECIAL SECTIONS

**UNITED STATES STEEL**

USS

# 9 PROVEN POINTS OF QUALITY ENGINEERING IN A LOW-COST HOIST



Cross section view of new Robbins & Myers type "J" Electric Hoist

The Fafnir 9100K Series ball bearing is designed basically for applications where housing diameters are restricted and maintenance of relatively large shaft diameters is essential. Available with seals or shields.

The Fafnir 200K Series ball bearing is well suited for applications requiring light to moderate loads combined with relatively high speeds. Available with seals, shields, and snap rings in various degrees of precision and retainer construction.

WHEN the design engineers of Robbins & Myers were asked to develop a low-cost electric hoist that would measure up to R & M standards of quality, they made good use of Fafnir Ball Bearings. They specified them to insure precise alignment of parts, conservation of power, minimum maintenance, reserve capacity for long life. In three critical locations they specified Fafnir Plya-Seal bearings — the bearings that provide superior retention of lubricant and positive protection against contaminants. With these and other construction features, they came up with the design of the new Robbins & Myers low-cost, "J" hoist, *quality engineered throughout.*

Fafnir is a supplier of ball bearings for leading industrial hoists, hoist trucks, and hundreds of other industrial machines and equipment where ball bearing advantages improve performance and prolong service life. In case after case, the choice of Fafnir Ball Bearings is influenced by the Fafnir "attitude and aptitude"—a way of looking at bearing problems from the designer's viewpoint and the ability to supply the right ball bearing to fit the need. Perhaps these attributes can help you solve a bearing problem. The Fafnir Bearing Company, New Britain, Conn.

**FAFNIR**

**BALL BEARINGS**

MOST COMPLETE LINE IN AMERICA

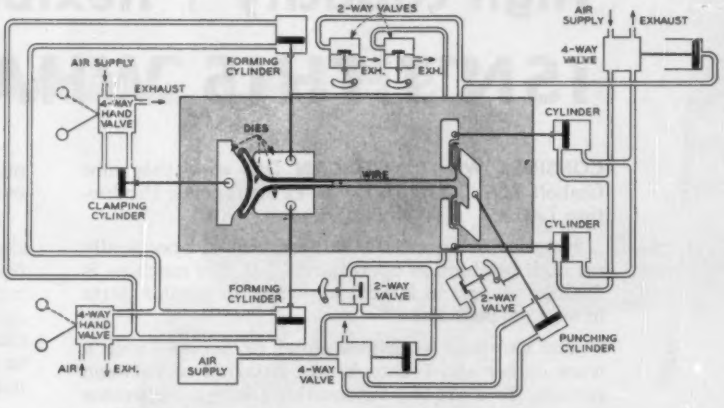
***Progress** in plan-it-yourself air systems:*

# How one plant cuts forming costs 75% with Schrader Air Products adapted to jig

Before this Schrader-powered forming jig was installed, an Ohio plant used heavy punch press equipment and costly welding procedures. Now man-hours and materials have been released for other work, and a single operator produces the finished part in seconds, effortlessly. Cutting the cost of the finished product by ¾!!

Every day Schrader Air Products are being integrated into the most diverse types of manufacturing operations. Versatile, safe, accurate air often makes the difference between profit and loss. And air acts faster than you think! Look into the opportunities in your own plant for modernizing with air. Schrader engineering facilities are available upon request to assist you in planning. Why not mail the coupon today?

Outdoor grill legs formed. Operator places wire between dies. Note Schrader products. Schematic below gives Schrader "Air layout" at end of cycle with wire formed.




**Schrader**
a division of **SCOVILL**

QUALITY AIR CONTROL PRODUCTS

**A. SCHRADER'S SON • Division of Scovill**
**460 Vanderbilt Avenue, Brooklyn 38, N. Y.**

If they can save money with air in Ohio—maybe we can, too!

Please send latest informative booklets which show Schrader's complete line of products.

Name_____ Title_____

Company_____

Address_____

**REDESIGNED HEADSTOCK** is massive, rigid casting, eliminating vibration and assuring maximum accuracy. Electric combination clutch and brake permits fast, smooth starts and stops without overheating. The Gisholt main control (manually or hydraulically operated) and the simple push buttons and feed-stop valves speed changeovers. A wide range of spindle speeds permits peak machining efficiency on all materials.

**GISHOLT JETracer** (mounted in place of standard front carriage) for either single or multiple pass work. For latter, JETracer will make up to four consecutive, automatic passes from four templates of different lengths and patterns. **Standard rear independent slide** can operate any time within the general machine cycle to complete the part. **Air- or hydraulically-operated tailstock** can be easily mounted, positioned or removed.

## High capacity + flexibility = economy

# ISN'T THIS WHAT YOU WANT

**CONSIDER WHAT YOU CAN DO** with this new Gisholt MASTERLINE No. 12 Automatic Production Lathe:

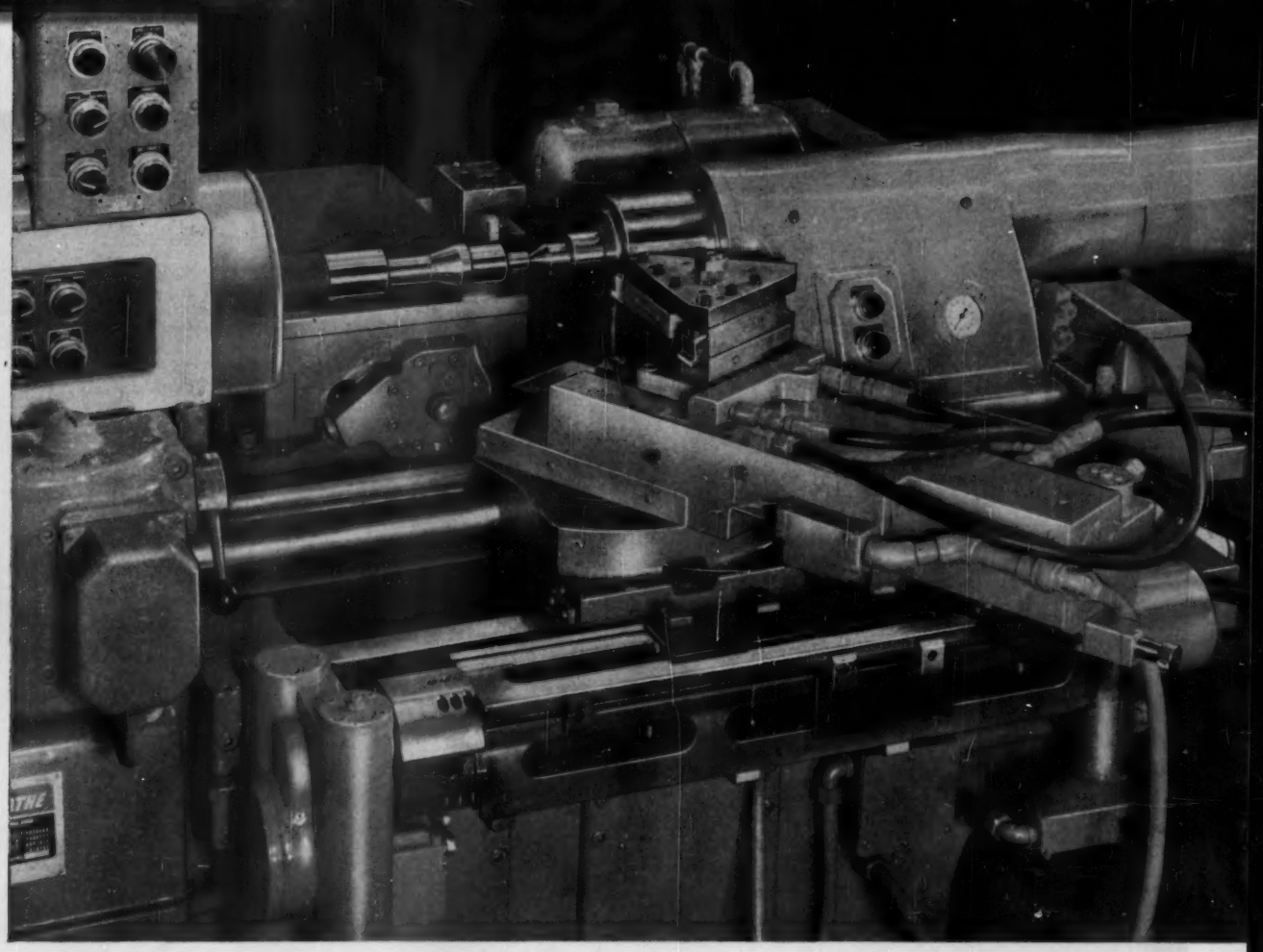
Here is an automatic lathe designed specifically for high production operations—yet this machine is flexible enough to handle a variety of similar parts in small repeat lots.

You can hold work in a chuck or fixture—with a work driver and tailstock—on an arbor or between centers. To start the automatic cycle, your operator simply loads the part, chucks it and raises the Main Control Lever. He is then free to handle additional machines—or to perform other work—until the part is completed.

On the Gisholt No. 12 Automatic, all carriage and slide movements are hydraulically actuated. The front carriage has both longitudinal and transverse motion—or a combination of the two—with quick approach, automatic tool relief and rapid return. You can mount the rear independent slide at any angle to machine bevel gears, drill cones, or handle other parts with angular surfaces.

For special jobs—like machining both ends simultaneously on small motor frames, cylinder sleeves,

MASTERLINE GISHOLT SINCE 1887 GISHOLT



# IN AN AUTOMATIC LATHE?

or similar parts— you get even greater flexibility from the No. 12 through auxiliary slides, operated by movement of the standard slides. Or you can mount a back facing attachment within the spindle—for still another way to machine a maximum number of surfaces in one chucking. And for outstanding versatility with great savings in tool and setup costs, the front carriage on the No. 12 may be replaced by a single- or four-pass JETracer slide.

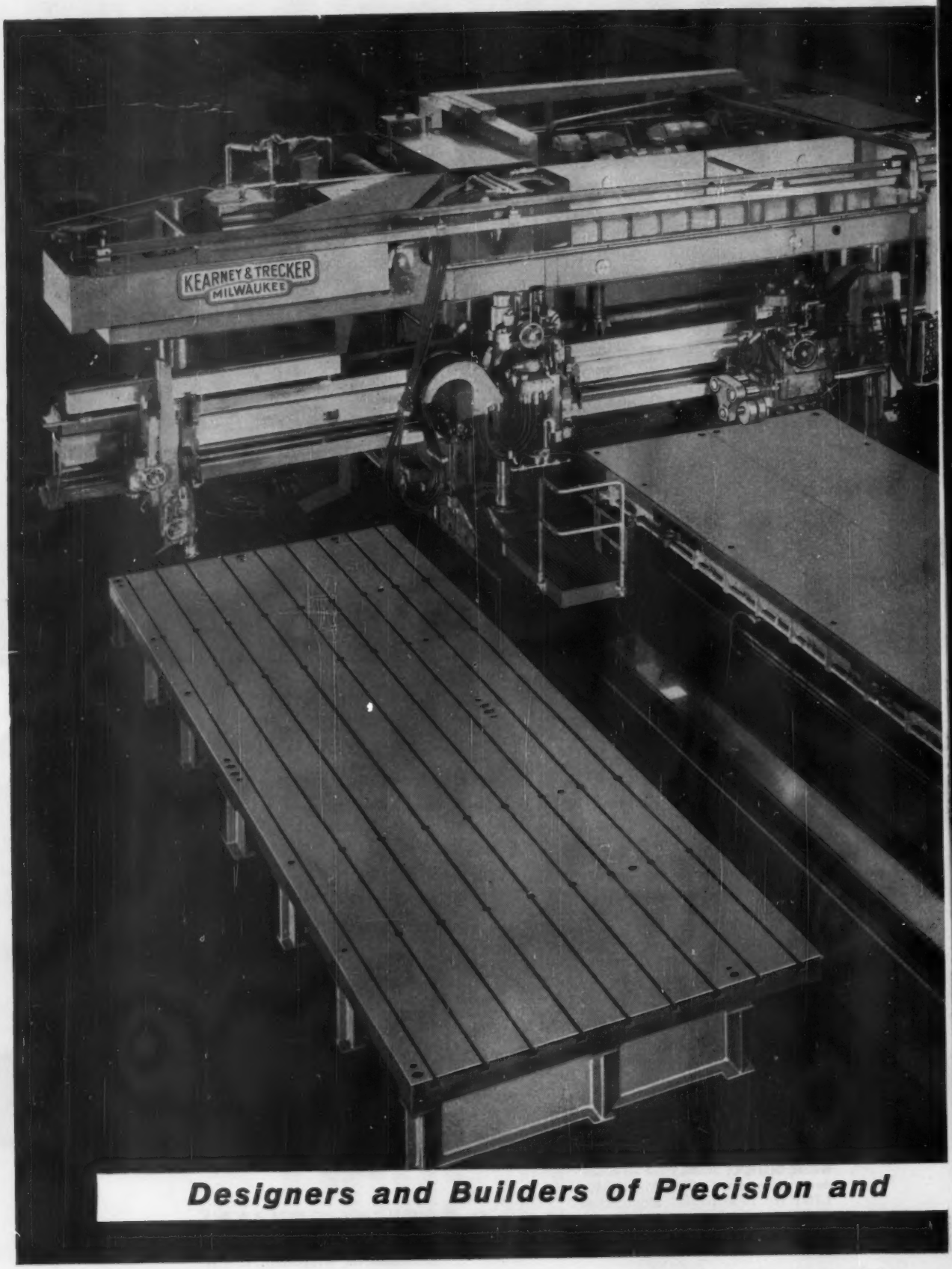
For complete details of the new features on the Gisholt MASTERLINE No. 12 Automatic Production Lathe, call your Gisholt Representative.

**WRITE GISHOLT TODAY** for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

**GISHOLT** MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

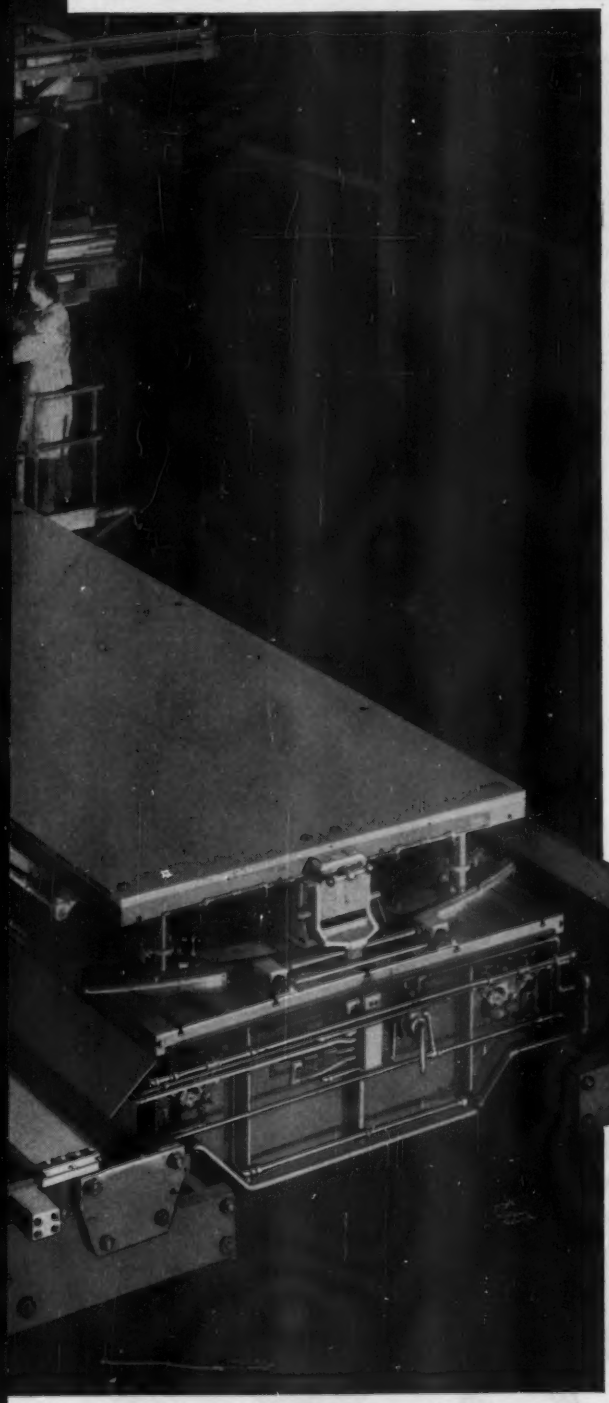

KEARNEY & TRECKER
MILWAUKEE
Designers and Builders of Precision and

# Picture your workpiece

## on this 175-ton

KEARNEY & TRECKER MILWAUKEE

## gantry type milling machine



THIS massive giant, 42 ft. long, 35 ft. wide, is equipped with electronic tracer control system designed for production milling of intricately contoured workpieces. Rugged enough to mill all metals . . . sensitive enough to hold close tolerances . . . it meets all A. I. A. specifications and has extendable bed design. Gantry type machine takes much less floor space and permits handling larger workpieces or multiple workpiece setups. Machine incorporates standard design components with automatic programming control systems available.

For more specific information on this gantry type milling machine, have our representative call at your convenience . . . or write to Kearney & Trecker, Special Machinery Division, 6786 West National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE

*Special Machinery Division*

MILWAUKEE 14, WISCONSIN, U.S.A.

***Production Machine Tools Since 1898***

# drive gears in BOLENS TRACTORS

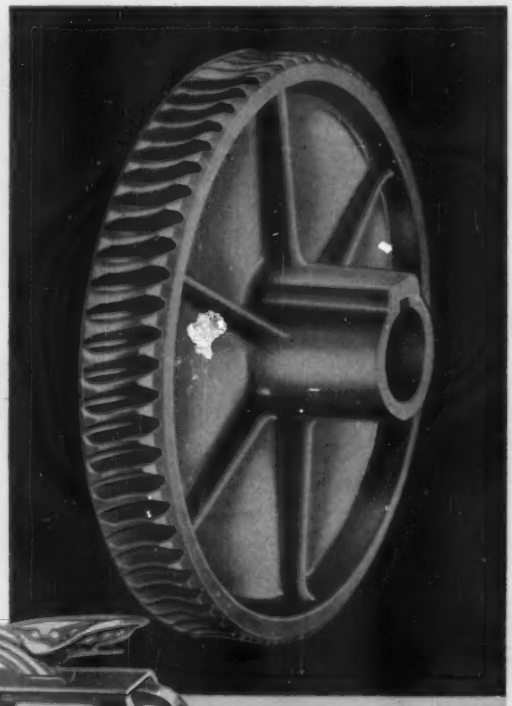
# toughness of MUELLER BRASS

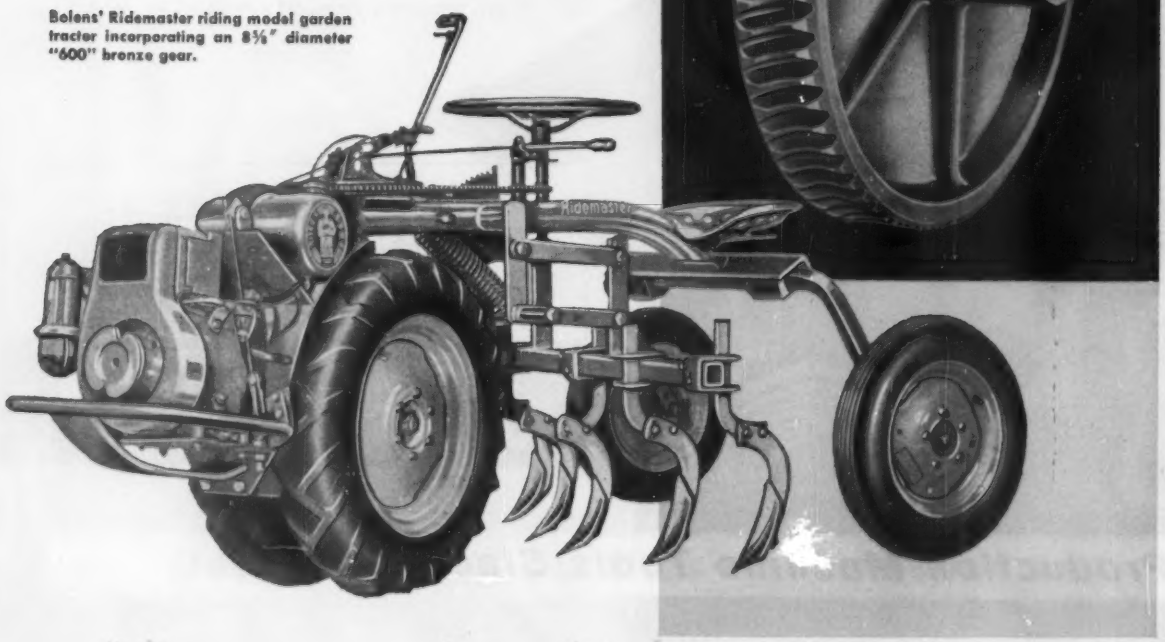
## "600" series bronze alloys

Forged bronze gears made from tough, long-wearing Mueller Brass Co. "600" bearing alloy are proving their ability to withstand punishment in the popular outdoor power equipment manufactured by the Bolens Products Division of Food Machinery and Chemical Corporation, Port Washington, Wisconsin. The Junior and Super Mustang rotary tillers, all employ "600" main drive gears to dependably transmit engine power to drive assemblies. The going is rough for equipment of this type in cultivating or tilling heavy soil—but Bolens has a record for ruggedness and, on these and many other Bolens products as well, Mueller Brass Co. "600" gears help make possible that fine performance.

Mueller Brass Co. "600" bearing bronzes are available as forgings, or in rod form. They provide unusually high tensile strength, a dense structure, good resistance to corrosion, and excellent bearing properties. Because of their good machining qualities, the "600" series bronzes can be finished readily—usually at substantial savings in COST.

It will pay you to investigate these alloys for your products . . . why not write today for full information.






Bolens' Ridemaster riding model garden tractor incorporating an 8⅛" diameter "600" bronze gear.

# and TILLERS prove

# CO.

Bolens' Super Mustang rotary tiller incorporating a 25-tooth "600" series bronze worm gear.

• WRITE TODAY FOR THE ENGINEERING MANUAL YOU NEED

Mueller Brass Co. Forgings Engineering Manual H-58565 ☐

Tuf Stuf Aluminum Bronze Alloys Engineering Manual H-58563 ☐

"600" Series Bearing Alloys Engineering Manual FM-3000 ☐

Copper Base Alloys in Rod Form Engineering Manual FM-3010 ☐

198

40 OUR 40TH YEAR MUELLER BRASS CO. 1917-1957

# MUELLER BRASS CO.

PORT HURON 24, MICHIGAN


## METALS AND ALLOYS REVIEW

by **FRANK M. LEVY**

**Vice-President and Director of Research**

One of the most interesting things about our 600 series bearing alloys is the great variety of products in which they find application. In the advertisement to the left you can see how the Bolens people put 600 gears to work in their rotary tillers and garden tractors. Those gears are big, take a lot of abuse, and meet the job needs perfectly. We also make a lot of small parts, too, that have been specified because of the many unusual properties of this series of alloys.

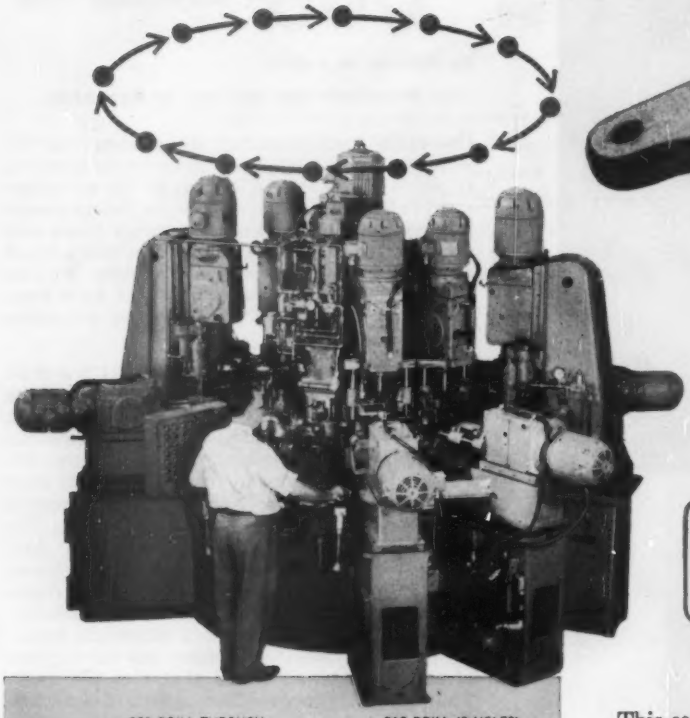
One good example that comes to mind is a shaft bushing on a rotary selector switch that we make for an instrument manufacturer. This selector is used for switching sound-powered telephone circuits aboard Naval vessels. One of the most important considerations in the choice of 600 alloy for this bushing was its resistance to abrasive action on and against a rubber "O" ring. The acceptance test required a stainless steel shaft riding in the bushing to rotate "dry" for a minimum of 50,000 cycles consisting of 360° rotation clockwise followed by a 360° rotation counter-clockwise. The "O" ring must still form a watertight seal at the end of the test. Our 602 alloy was the only one of several materials tested that met the specs. That was pretty good evidence in itself of resistance to abrasion, but, in addition, this customer also found that the use of 602 eliminated the headaches they previously had with seizing and galling.

The pounding action caused by the indexing mechanism attached to the shaft used to give them no end of seizing troubles. The chief product engineer is extremely happy about the way our alloy is performing. Mention was also made of the fact that the corrosion resistance of 602 was mighty impressive. In this application, the alloy passed the 200-hour Navy salt spray test with flying colors.

So, big or small, it seems that there is no end of applications for 600 series alloys. We even have parts working in a machine that slices frankfurters as well as gears in fishing reels. So, it seems that 600 runs the gamut from "red hots to reels". Well, it looks like the end of the page is here again, so I'll close for now. However, if you have any problems or questions about non-ferrous alloys or you're having trouble getting desired performance from a part, why not drop me a line here in Port Huron, and possibly I can be of some service. Send a part print along if you like, and we'll be glad to make proper recommendations.

Thanks again for your time.

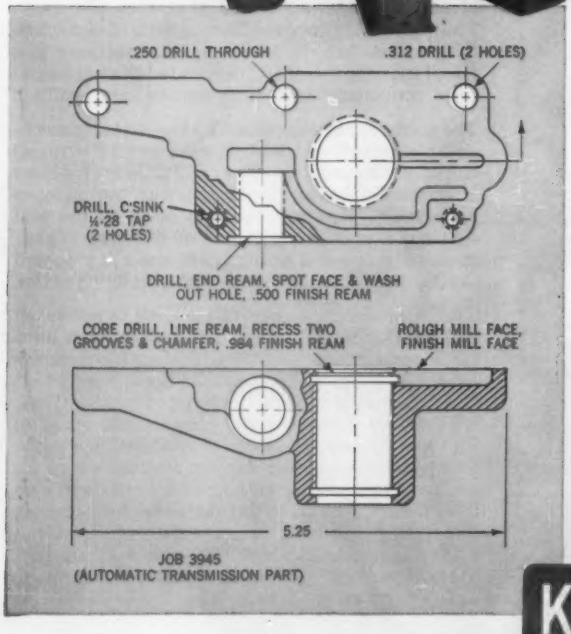
mill
drill
ream
recess
spot face
countersink
tap



## 200 PARTS PER HOUR GROSS

on this 12-station

# KINGSBURY




This central column Kingsbury has 13 units which operate 19 spindles. A loading assembly positions the work (an automatic transmission part) for clamping by an air-actuated mechanism. Two vertical units with adjustable arbors mill the joint face; a recessing unit works on the snap ring grooves. Thirteen tools have guide bushings. Finish reaming is done last, after the heavier operations are completed. Indicator lights signal the operator if any operations are unfinished.

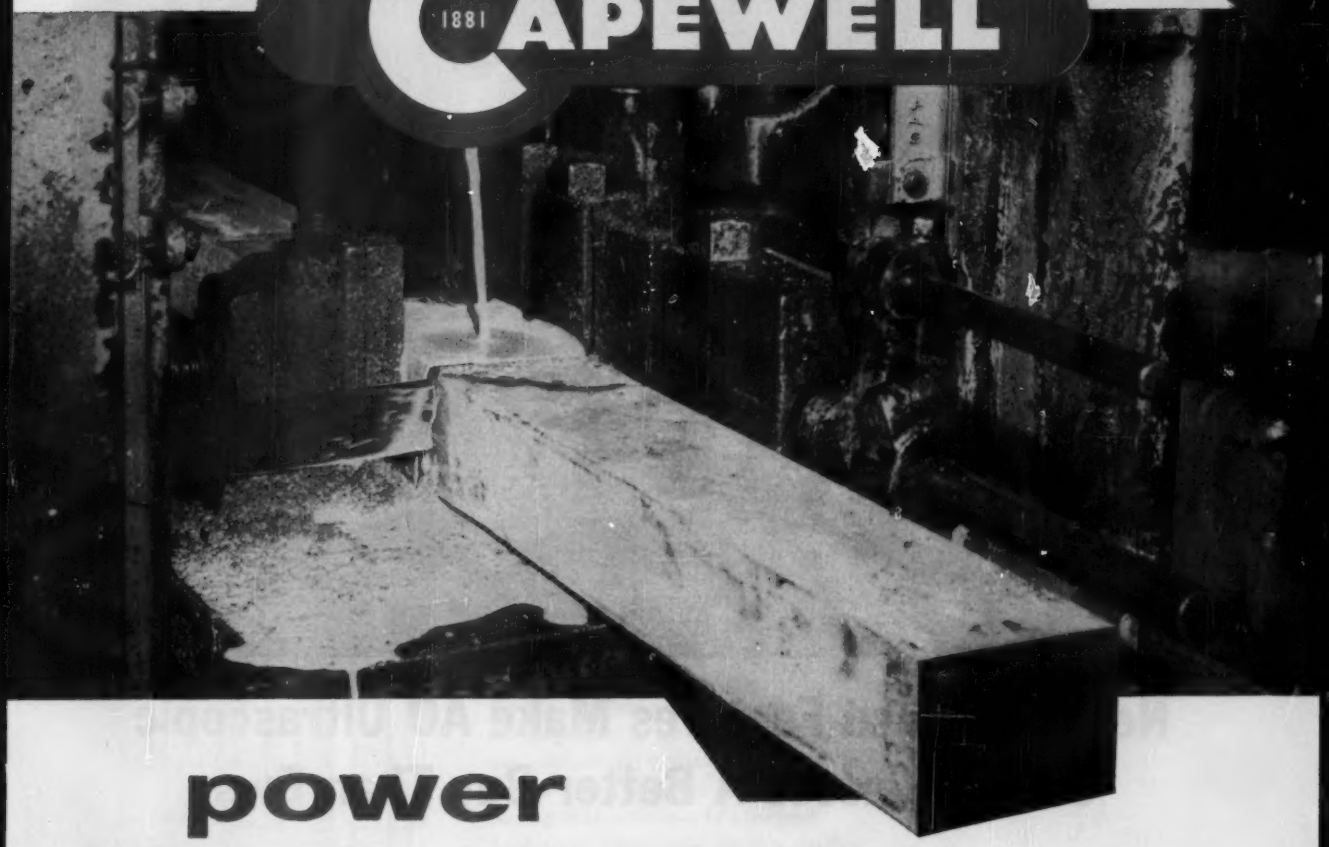
Most Kingsburys are less elaborate. But all have the same purpose:

uniform operations
at a high production rate
to the customer's specification
at low unit cost

May we get together on one of your jobs, simple or complex? Kingsbury Machine Tool Corporation, Keene, New Hampshire.

**KINGSBURY**
INDEXING AUTOMATICS
for high production drilling and tapping

# cut it with CAPEWELL stop



# power hack saw blades

**THE USER:** Wheelock, Lovejoy & Co., Inc., Cleveland Plant.
**THE MATERIAL:** Alloy Steel Billets.
**THE JOB:** Maintaining normal production line speeds.
**THE PROBLEM:** Power hack sawing creating production bottleneck.
**THE ANSWER:** Capewell Safetech Power Hack Saw Blades.
**THE RESULT:** Power hack sawing now a routine operation—no more production headaches.

Wheelock, Lovejoy chose Capewell's shatterproof Safetech blade for this long, heavy job because they could get more cuts per blade, quickly and economically under heavy feed, while providing complete operator safety. Other Capewell power hack saw blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

76 CAPEWELL ANNIVERSARY

*SOLD ONLY THROUGH CAPEWELL DISTRIBUTORS who provide: complete inventory . . . engineering assistance . . . delivery when you need it.*

**THE CAPEWELL MANUFACTURING COMPANY**
Hartford 2, Connecticut

Please send complete details on Capewell Power Hack Saw Blades to:

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

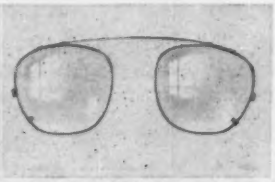
4CA58A

# New Advanced Features Make AO Ultrascopic Safety Glasses A Better Buy Than Ever

When we introduced American Optical Ultrascopic Safety Glasses, we intended them to be the finest, most advanced eye protection equipment available. They were enthusiastically accepted by industry at all levels. A tremendous increase in eye protection sales attests to this success. They truly have been "a new dimension in eye protection."

However, in keeping with American Optical's policy of making good products even better, continual American Optical research and laboratory testing have developed many new improved features on American Optical Ultrascopic Safety Glasses. Now, with these advanced refinements, they are a better buy than ever.

New Wrap-Around Case No. 954 of Cordovan vinyl. Won't wrinkle, peel or crack.



American Optical Fits-On Goggles which protect Ultrascopic Safety Glasses from pitting and scratching.

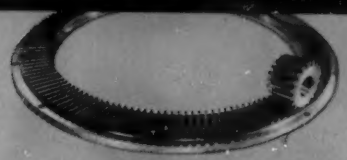
1. The F9500 Series in copper bronze. This handsome styling will appeal to all and to women workers in particular.
2. The F9500 Series with clear transparent side shields, thus increasing side vision.
3. Spatula tip temples for the F5100 Series without side shields.
4. The F9500 acetate Series is available with metal screen side shields. The F5100 metal series is available with all plastic perforated side shields.
5. Both series are available with 6 curve Plastolite (plastic) lenses.
6. New case with pocket clip (No. C954) and without pocket clip (No. 954) has been developed to accommodate either the metal or acetate goggle without side shields.
7. New Ultrascopic Fits-On Goggles. These are designed to fit either the F5100 or the F9500 Series with or without side shields. Glass or plastic lenses. Glass lenses clear and Calobar ground and polished Meniscus. Plastic lenses, clear or green meniscus. Model 21W for metal safety glasses, model 22W for acetate. 42-44-46-48 mm. eye sizes.
8. Both the F5100 and F9500 series are available with "Balanced Vision" in Ful-Vue glasses. Workers who need correction are assured of balanced or "compensated" vision from lens edge to lens edge.

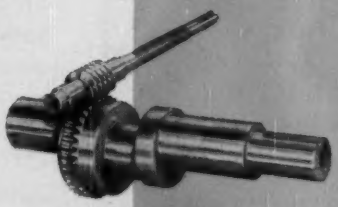
American Optical
COMPANY
SAFETY PRODUCTS DIVISION

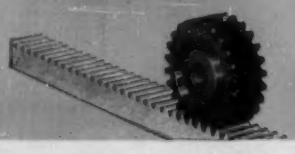
Always insist on Trademarked Lenses and Frames. Your nearest American Optical Safety Products Representative can supply you.

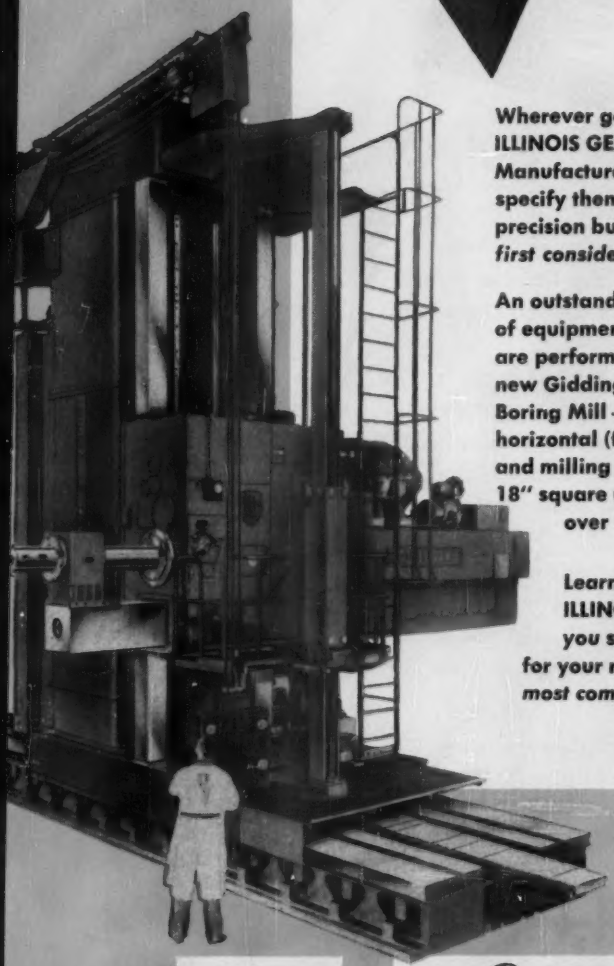
SOUTHBRIDGE, MASS., BRANCHES IN PRINCIPAL CITIES

# Gears For every Purpose









**Wherever gears are used, the name ILLINOIS GEAR is known and respected. Manufacturers of fine equipment always specify them. ILLINOIS GEARS are precision built with *quality as the first consideration.***

**An outstanding example of the type of equipment in which ILLINOIS GEARS are performing a vital function is the new Giddings & Lewis Model 1210-FUAR Boring Mill — *the world's largest* horizontal (floor type) boring, drilling and milling machine with 10" spindle, 18" square underarm and weighing over 200 tons.**

**Learn for yourself how ILLINOIS GEAR *can help you* select the right gears for your requirements from *America's most complete line of gears.***

***Look for this mark*** ILLG® ***the symbol on finer gears***

ILLINOIS GEARS

*Gears for Every Purpose* ... **one gear or 10,000 or more**

# ILLINOIS GEAR & MACHINE COMPANY

**2108 NORTH NATCHEZ AVENUE**
**CHICAGO 35, ILLINOIS**

Teeth Don't Strip on This "Best for General Cutting"

# SIMONDS WAVY SET BAND SAW BLADE

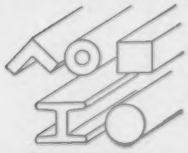
If you cut pipe, angle iron, channel, I-beam, bars, etc. — here's the blade to use because it can handle all types of cutting. It's designed especially for general purpose use.

Note that the teeth are *wavy* set (set in groups) as shown at left. This distributes strain over more teeth and makes it possible to cut all sizes, shapes and types of material *without stripping the teeth*. Fast and smooth cutting, it stands more abuse, lasts longer, cuts costs.

This general purpose blade is made of tough, wear-resistant alloy steel and is available in a variety of widths and tooth spacings. It will pay you to try SIMONDS Wavy Set Blade for *your* general purpose cut-off work.

**QUICK FACTS**

- Cuts all shapes and types of materials



- Saves changing saws — one saw can do the work of several
- Longer life — cuts blade costs
- Withstands abuse
- Furnished in 100 and 250′ Coils or Welded-to-Length for Specific Machines

**WAVY SET BAND SAW BLADE SIZES**

| Width Inches | Thickness | Teeth per Inch |
|---|---|---|
| ½ | .025 | 10-14-24 |
| ⅝ | .032 | 10-14 |
| ¾ | .032 | 8-10-14-18 |
| 1 | .035 | 10 |

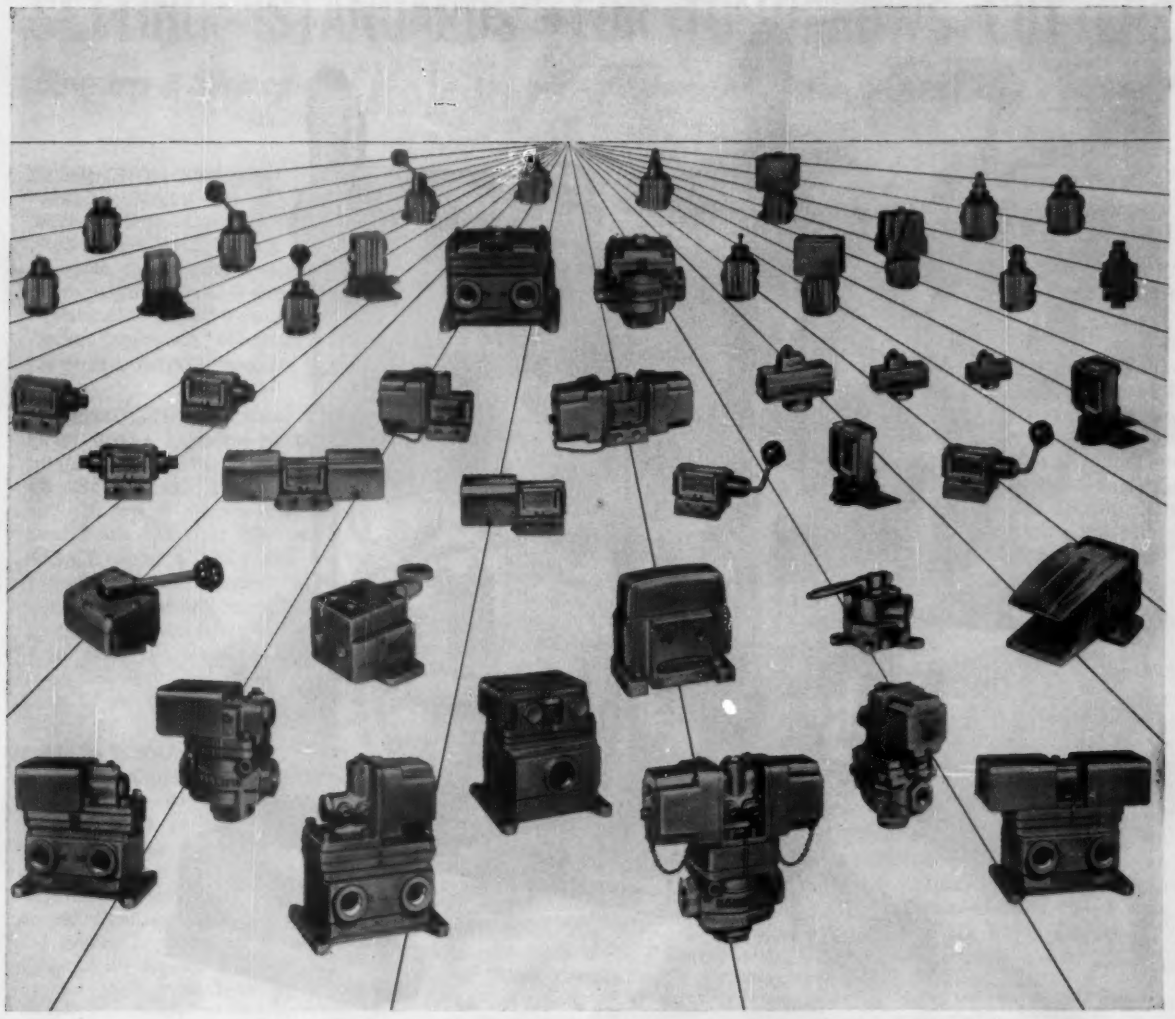
**For Fast Service from Complete Stocks Call your SIMONDS Industrial Supply DISTRIBUTOR**

*125 years of growth 1832-1957*

**SIMONDS SAW AND STEEL CO.**

FITCHBURG, MASS.

*Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada*



# These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

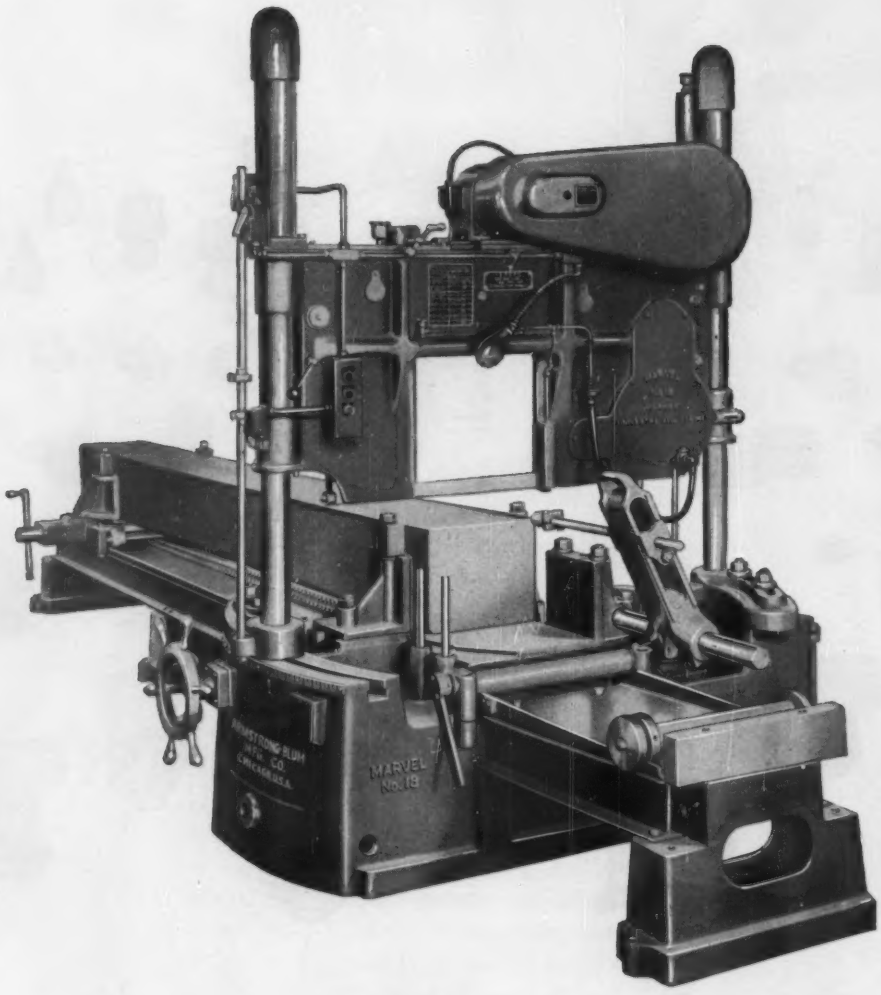
Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

**AIR CONTROL**

**HANNIFIN**

**VALVES**

***For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 517 South Wolf Road, Des Plaines, Illinois.***




# No Job too big or too tough . . .

## for MARVEL "*Giant*" Hack Saws

These giant MARVEL Hydraulic Hack Saws (No. 18, Capacity 18" x 18"; and No. 24, Capacity 24" x 24") were *basically* designed for rapid and economical cut-off of BIG WORK. They are not merely "conventional" designs "stretched" to big capacity. They are truly designed and built with the ruggedness and rigidity necessary to withstand the rough treatment of sawing big work, even though the work is in the "toughest of the tough" alloys.

They are reliably fulfilling the cut-off requirements in innumerable steel mills, forge shops, structural shops, warehouses, and machine shops, with assured low tool cost and minimum kerf loss of steel.

In addition to cutting-off, they are reducing costs by eliminating further machining operations. Heat treated die blocks are being reclaimed for re-sinking by sawing off the worn face; columns, beams, pipe, and tubing are being sawed to *finished*, square ends, eliminating milling; angular sawing is done conveniently by swinging the upper structure on the base, to any angle up to 45 degrees—*without moving the work*.

Contemplating the modern trend toward ever tougher steels and larger sizes, these are the logical sawing machines to buy, not only for today's needs but for tomorrow's as well.

*Write for Catalog*

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

**ARMSTRONG-BLUM MFG. CO.** 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

# SETTING "STANDARDS" FOR TOMORROWS CUTTERS!

## *Brown & Sharpe — NELCO A Tremendous Tooling Team!*

**PRODUCTION SERVICE—**
Now, the largest line of "standard" Solid Carbide, Carbide Tipped and High Speed Steel Milling Cutters is available to America's metalworking plants without wait, worry, waste or downtime! It's a fact—more than 3000 stocked "standards" eliminate the need for most expensive "special" tools.

**DISTRIBUTORS' STOCKS—**
Every Brown & Sharpe-NELCO Distributor stocks for prompt service wherever you are. Over 2300 "standard" Brown & Sharpe High Speed Steel Tools and over 700 "standard" NELCO Solid Carbide and Carbide Tipped Tools are available to answer over 90% of milling problems. Speedy service on "specials" is also available when necessary—specials engineered by a Tooling Team with over 140 years of metalworking experience.

**FIRST IN TOOLING—**
Galloping competition in industry today makes it vital that new improved machine tools be equipped with the *best* in tooling. The tool is the pay-off-point of every machining operation, whether on new, modern equipment, or old. Precision production, machining speed, product delivery, product quality—all depend on the excellence of the tooling used in production. When it's Brown & Sharpe-NELCO Tooling, the result adds up to Profits, Growth and Prosperity.

**ADVANCED DESIGN—ENGINEERING—**
Not only the largest milling cutter line in the world, but the most expertly engineered tools are available. Brown & Sharpe-NELCO, pioneers in the tooling field, have constantly led the tooling industry with new designs and inovations that have today become industry standard. You can be sure—if it's good tooling practice—you will get it from your Brown & Sharpe-NELCO Tooling Team FIRST!

**CALL YOUR DISTRIBUTOR—**
Keep a copy of the 50 page NELCO Catalog C-14A and a copy of the Brown & Sharpe Cutter Catalog handy. They are your reference to speedy service on over 3,000 "standard" Carbide Tipped and High Speed Steel Milling Cutters. Your local distributor will "jump" the minute you call. Remember: because they are *best*, they are also the *easiest* to buy!

**PRODUCTION RECORDS**
No wonder users of th… breaking production … are *up*—down time is w… —waiting is p… liveries are … and product … Sharpe-Nelc… re… 00.

**SE…**
Se… sta… the … the … backed… engineers wh… shoot production problems in … customer's plant give off-the-shelf delivery … complete line of Milli… today!

**SALES RECORD…**
Brown & Sharpe… NEL… Carbide… Tool… initely repre… *fastest grow…* …*e* of cutters in the world! The … s for this … th rec… that … argest … of cutte… best … engineered are a… …sie… to get.

**WHICH TOOL TO …ET**
With over 2300 Brown & Sharpe High Speed Steel Cutters a… …0 NELCO Carbide … available through … and service org… …ms to use" is neve… No… tisan sales recom… ways available— … right job is always as… … phone—and expert attention t… your individual probl… guarantee … lutions to th… …ult tooling problems.

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… & Sha… NELCO Dis… …ocks:
High Speed… …g Cut… ters, Coars… …ters, Helical M… … Milling … …ut… ters, F… …End Mills, … Shell End Mi… … Cutters, A… … Slot… …ng Cutters, … Spur Gear …rs, Cutter … Cam Lock … Cutter Adapters, Chuck Adap… …rs and Spring Chucks.

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80 PAGE CUTTER CATALOG
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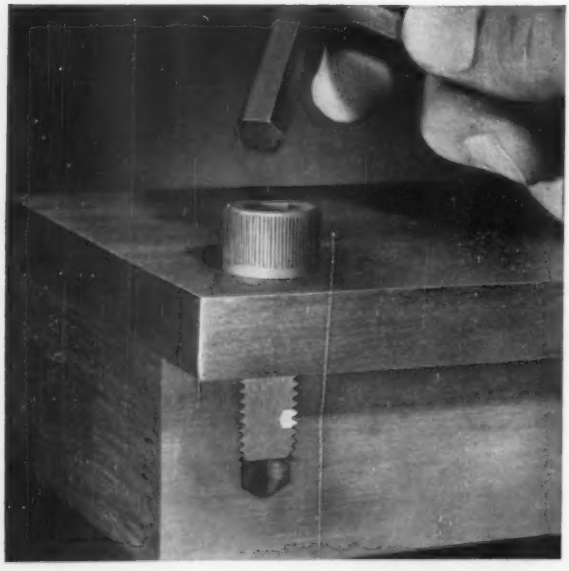
…gh …0 …ll …es …ation—"which tool …o use" is never a problem. Non-partisan sales recommendations are always available.

…tooling. You will be days and days ahead when you

**The ordinary fasteners** securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

# Vibration won't loosen self-locking UNBRAKO socket cap screws



**HOW IT LOCKS.** The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

UNBRAKO® SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

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*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

## First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.

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CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

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## High Speed Precision
# MILLING MACHINES

**The RIGHT Size For Work Which is**
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- Saves Production Time
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1 1/16" Cutter Spindle Capacity
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Eight Spindle Speeds —
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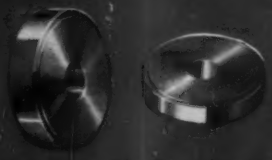
XLO

EX-CELL-O FOR PRECISION

Complete automation unit for machining steel gear blanks. Note dial groupings at gaging stations visible in this picture.

Ex-Cell-O Style 312 Cam Boring Machine adapted for automation. Components on cross slide automatically adjust tools to hold specified limits.



Typical gear blanks after automatic machining is completed.

# Standard Ex-Cell-O Machines Handle Automatic Operations

**Take these cam boring machines, for example: they are standard Ex-Cell-O 312s. When a customer's production schedule called for an unusually high per hour output of steel gear blanks Ex-Cell-O engineers incorporated these machines into an automated setup.**

**Included in the new setup: two cam-operated Ex-Cell-O Precision Boring Machines, two Gear-O-Mation storage-distribution units, three gaging stations.**

**The boring machines finish all the surfaces of the gear blanks: face both sides, chamfer both inner and outer edges, bore the central holes and turn the outside diameters. Tools are adjusted automatically to maintain required tolerances. Gage units automatically check parts prior to entering the machining stations, and the storage-distribution units provide space for a bank of parts at each machine station.**

**If you're interested in automation, but are held back by the high cost of specially designed machine tools, call your nearby Ex-Cell-O Representative today. Perhaps a standard Ex-Cell-O machine tool setup can be adapted to your automatic operation requirements. Or, if you prefer, contact Ex-Cell-O in Detroit directly.**

**EX-CELL-O**
CORPORATION
DETROIT 32, MICHIGAN

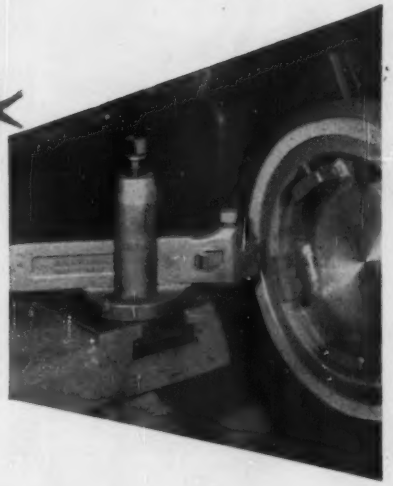
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

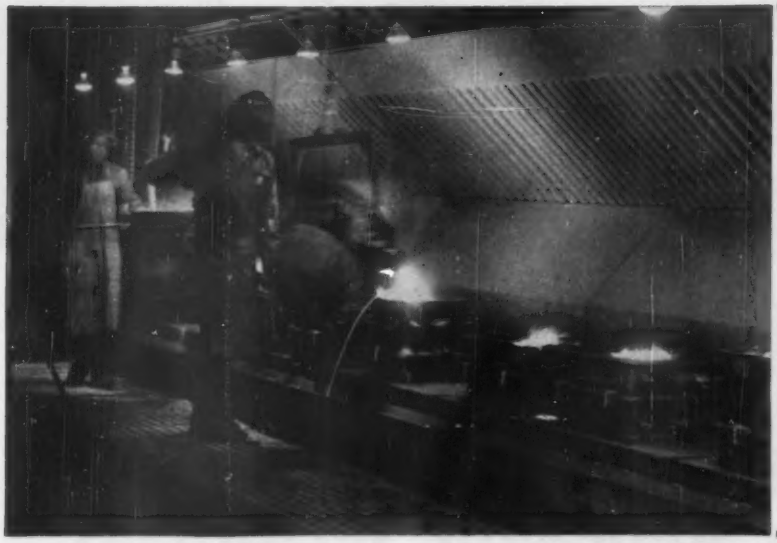
57-21

## PROVED BY INDEPENDENT LABORATORY TESTS:

# 62% S·M·I*

## for FERROCARBO®-TREATED IRON





Progressive foundrymen seeking to improve the machinability and quality of gray iron and malleable iron castings can now rely upon FERROCARBO—the patented additive in briquette form—by CARBORUNDUM. Tests by a widely-known independent research organization, have proved conclusively that the addition of FERROCARBO® to the cupola charge results in finer-grained, denser, and stronger castings with a machinability improvement factor as high as 62% over untreated iron. The better *dispersal action* of FERROCARBO and the resulting *better machinability* of the iron, are your assurance of a *better satisfied* customer.

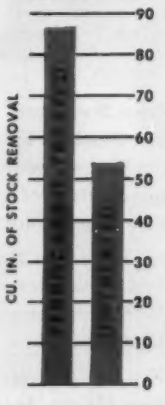
* Surface Machinability Improvement

### HOW TESTS WERE CONDUCTED

Tool-wear tests were conducted on metal cast in leading foundries across the country, using untreated iron and Ferrocarbo-treated iron of identical or similar chemistry. Both were machined at commercial speeds using a single point "Carboloy," grade 44A tool. Tool life was determined by measuring wear on the flank of the tool with a 100-power microscope. The charts at the right show actual test data as reported.

➡ **WRITE FOR MORE INFORMATION** on how FERROCARBO produces more machinable iron, regardless of metal composition. Ask for booklet—Form A-1409—Electro Minerals Division, The Carborundum Company, Niagara Falls, New York.

| Chemical Analyses | Untreated | Ferrocarbo® Treated |
|---|---|---|
| C | 3.57 | 3.56 |
| Si | 2.25 | 2.26 |
| S | .10 | .10 |
| Mn | .68 | .66 |
| P | .11 | .11 |
| Cutting speed (ft./min.) | 300 | 300 |
| Feed (in./rev.) | .009 | .009 |
| Depth of Cut (in.) | .062 | .062 |
| Wear land (in.) | .015 | .015 |
| Vol. of metal removed (cu. in.) | 53 | 86 |
| Weight of metal removed (lbs.) | 13.7 | 22.2 |
| Per Cent improvement | | 62% |

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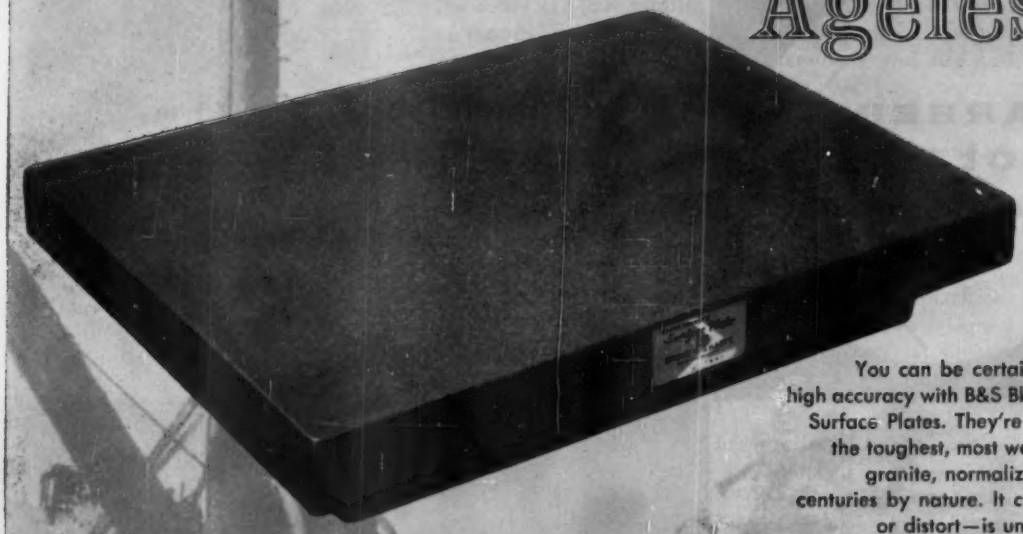
# Accuracy that's Practically Ageless!



You can be certain of *lasting* high accuracy with B&S Black Granite Surface Plates. They're made from the toughest, most wear-resistant granite, normalized over the centuries by nature. It *cannot* warp or distort—is unaffected by body temperature. In addition, it has the highest compressibility strength*, greatest density, and lowest absorptivity of any granite suitable for surface plate use!

## BROWN & SHARPE BLACK GRANITE SURFACE PLATES

Toolmakers' flats, parallels, straight edges, and angle plates are also available in the same high-quality, top-accuracy black granite.

That's why B&S Black Granite Surface Plates provide super-smooth, uniformly hard surfaces... the *best* base for all your precision checks, measurements, and layouts. What's more, they require practically no attention: Can't rust, stain, or corrode; never need rescraping or oiling; can be easily cleaned with little more than a wipe of the cloth! Get full details on these more accurate, more economical aids to precision. Available with surface accuracy of 0.0001" or 0.00005". Write Brown & Sharpe Mfg. Co., Providence, R.I.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

**Brown & Sharpe** B·S

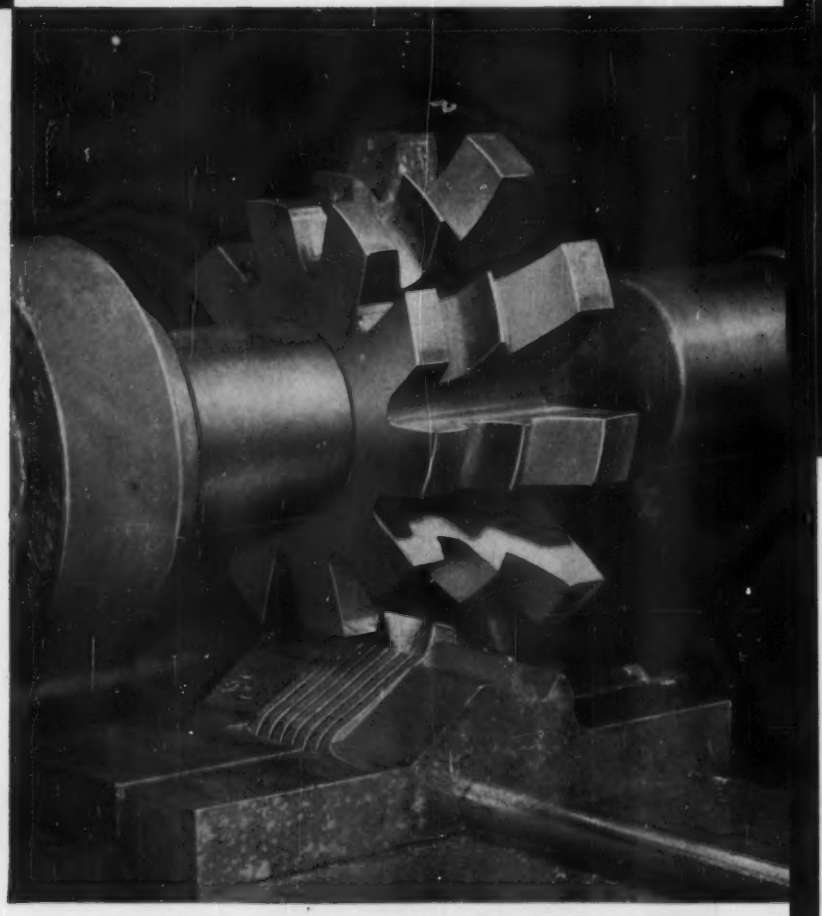
*In a series of comparative tests made by the National Bureau of Standards, this same type of granite proved strongest (54,400 p.s.i.); most dense (3.024 true density); and least absorptive (.07%).

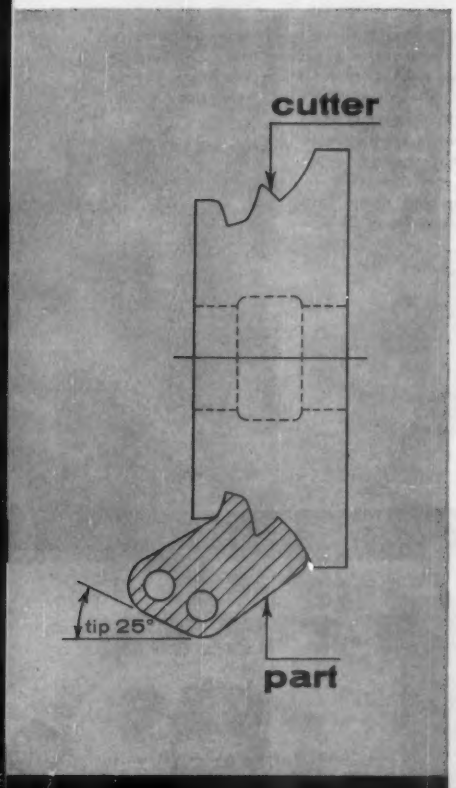
*top cutter design*
*saves 50% in cutter cost,*
*reduces cutter breakage*

**BARBER-COLMAN recommends:**

**a single solid form relieved cutter to replace two former cutters**

**improved design to increase tool life and reduce cutter breakage**





This Barber-Colman unground form-relieved milling cutter takes the place of two milling cutters formerly operated as a gang for milling these lever sectors. The proportions of the cutter were improved by reducing the cutter diameter and increasing the bore diameter. These improved proportions provide greater rigidity in the cutter and in the milling operation. As a result, initial cutter cost has been reduced 50%, and cutter cost-per-piece further reduced through extended tool life and reduced breakage.

The form on the workpiece is located with respect to the cutter axis to allow sufficient clearance behind all cutting edges. In this particular application, the workpiece is positioned at 25° relative to the cutter axis, permitting the manufacture of a one-piece cutter with adequate cutting clearance.

The material in the part is soft steel of maximum machineability. For best cutting efficiency, the cutter was designed with adequate clearance for milling this material. Cutters are 5″ diameter with 1¼″ bore as compared with previous cutters of 6″ diameter and 1″ bore.

Replacement with a single form relieved cutter has simplified cutter resharpening and reduced cost-per-piece. All Barber-Colman form relieved cutters are index sharpened across the face of the teeth. Cutters are simply and easily resharpened on conventional equipment or Barber-Colman automatic hob and cutter sharpening machines.

With Barber-Colman improved cutter design, pieces are milled at the rate of 3½″ per minute feed, and 150 R.P.M. cutter speed. Tool life averages 3,000 pieces per sharpening.

If you are seeking ways to improve your milling cutter efficiency, consult Barber-Colman cutter engineers. Their skill and experience in applying advance cutter design features will help to solve your milling problems.

**BARBER-COLMAN COMPANY**

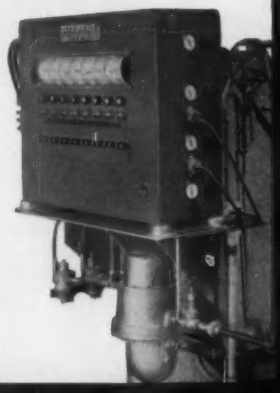
815 ROCK STREET • ROCKFORD, ILLINOIS

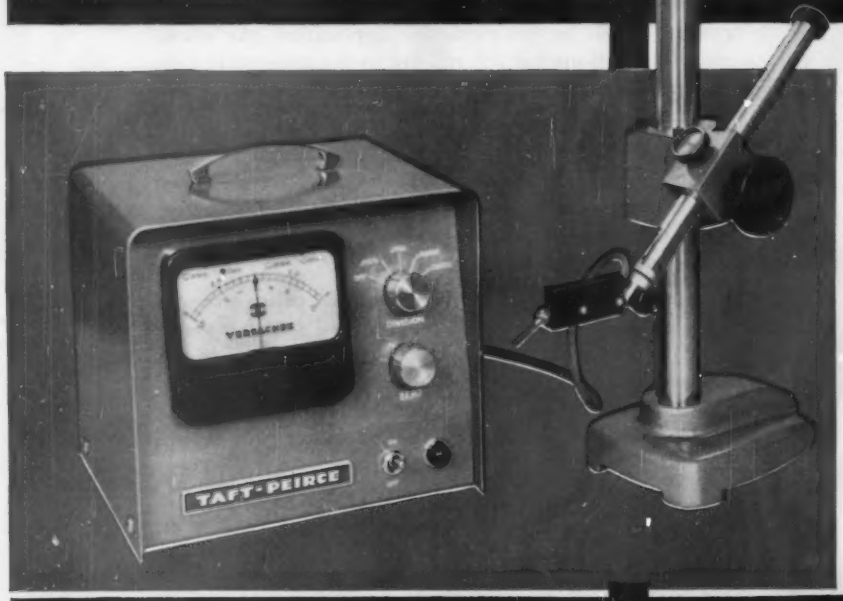
*Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines*

BARBER COLMAN

**T-P Ingenuity Puts Profit Into Automatic Gaging and Sorting** . . . Taft-Peirce Air-Electric Gaging has resulted in a variety of automatic gaging and sorting machine installations. Individual parts are air gaged for size, then dropped into bins marked with size categories. T-P creative engineering makes mass inspection and sorting of parts a profitable reality in your plant.

**Taft-Peirce Gaging Stations** bring rugged performance plus tight tolerance control to transfer lines . . . T-P equipment handles a multitude of dimensions on a day-in day-out basis, repeating readings without fail. There's one right answer to every automatic or semi-automatic gaging application, so take advantage of specific experience in this specialized field . . . take your problem to the Taft-Peirce Instrument Gage Division.



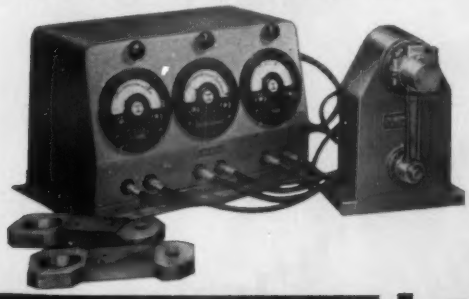



**New Versachek Electronic Comparator** laboratory accuracy at minimum cost . . . Taft-Peirce provides application versatility plus laboratory precision, priced to appeal to every shop large or small. Four switch-selected graduations: .0005", .0001", .00005", .00001" — all on one dial. Calibration is simple, with 100% linearity over entire scale. Use a Versachek to police wear on shop working gages, for size control beside the machine, or use special output jack with oscilloscopes, ink recorders, and other inspection devices.

**New Packaged Control Center For Simplified Feedback Gaging** . . . Here's in-process quality control with minimum investment in equipment. Buy this air-electric control unit from stock and apply it to on-the-machine inspection. All accessory fixturing is available from one source — Taft-Peirce — plus whatever application help you need. Use for size control with pass or reject indicated by pilot lights.

**New Functional Styling For T-P CompAIRator Air Gages** . . . Special slanted face has glare-reducing visor for easier reading under all lighting conditions. Zero and range setting knobs are within easy reach of the inspector. Plus production-tested T-P Velocity-Venturi Air Circuit for exceptional dependability and accuracy. Use the CompAIRator to sort at the bench with instrument-mounted plug, ring, or snap gage, or at the machine with air hose extension.

**New! Pass or Reject Parts** having related dimensions by one computed reading on one dial . . . Patented Taft-Peirce CompUtair streamlines jobs requiring: (1) check of taper between two diameters, (2) alignment or concentricity of two diameters, (3) squareness of bore to face, (4) center distance without respect to hole size, (5) bend or twist developed during machining. Pass or reject a number of product dimensions simultaneously with one composite reading on one dial. You can't beat the CompUtair for speed and economy on any long-run job.



# Look what TAFT-PEIRCE is Doing with INSTRUMENT GAGING

***New, Electronic Versachek plus redesigned CompAIRator bring wide versatility, extreme accuracy to quality control.***

Like to find new ways to do things? Cut corners? Shave costs? Help your company build a better product?

There's almost always a new way to do it with Taft-Peirce Air Gaging! Engineers are continually finding more opportunities to streamline inspection and quality control with Taft-Peirce Instrument Gaging.

Take advantage of all the "tricks to the trade" in gaging. Consult Taft-Peirce for the most advanced, lowest-cost solutions to your problems.

*Get all the Facts* . . . from your nearest Taft-Peirce representative or write for Air Gage Bulletin No. 613.

## TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, R. I.

T-P Means TOP Precision

Operators know Card taps are action-mated precision performers — for example, on materials like cast iron, brass, stainless steel, aluminum and magnesium. That's because these top-quality tools are always available with different cutting angles and surface treatments — at standard prices. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

# CARD

DIVISION OF UNION TWIST DRILL COMPANY

***— Serving you through fine distributors from Coast to Coast***

Henry Rosenfeld, President of Henry Rosenfeld, Inc., asks:

# "Which model has the most dates?"

"One of these models has kept only one date – the other, over 50,000!

"On the left is the one-date model – the original, handmade, custom-designed 'Henry Rosenfeld dress #5026.' Its only date was our Spring showing.

"On the right is a copy. The dress caught on, became a 'hot number' and we had to deliver it – fast! Thousands of copies were shipped to hundreds of stores – without missing one date – thanks to Air Express.

"Buyers all over the country, knowing how much we ship via Air Express, planned their promotional programs and sales with no fear of a hitch.

"Using Air Express, we regularly meet the fierce competition of the fashion business. And we save money doing it!

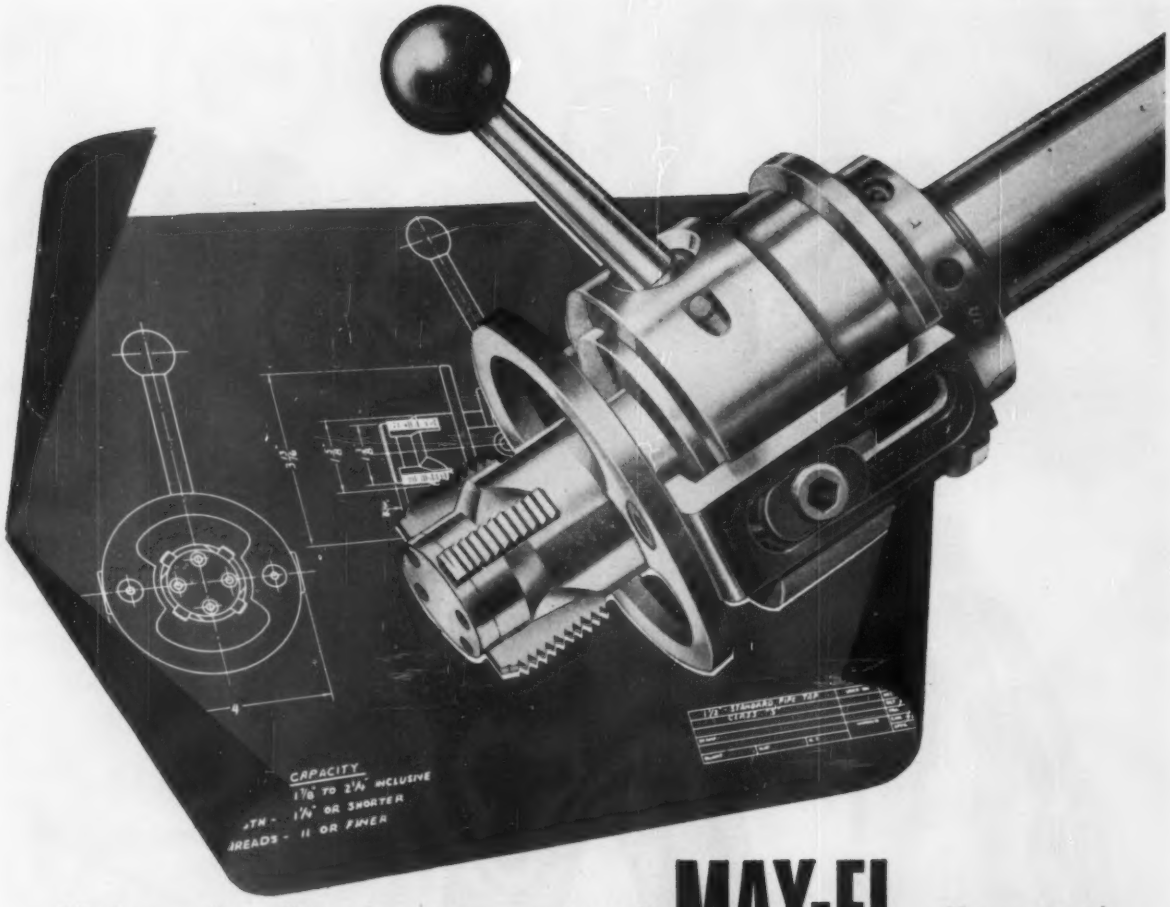
"For example, a typical 15-lb. shipment from New York to Richmond, Va., costs $3.23 with Air Express – $3.82 less than any other complete air service.

"What's more, Air Express uses radio-controlled trucks to rush our shipments to and from airports – and, whenever necessary, a private teletype system to trace shipments instantly."

**Air Express**

**30 YEARS OF GETTING THERE FIRST** *via U.S. Scheduled Airlines*

**CALL AIR EXPRESS** . . . *division of* **RAILWAY EXPRESS AGENCY**




# Universal collapsing tap parts of **MAX-EL** alloy steel finish machined after full heat treatment

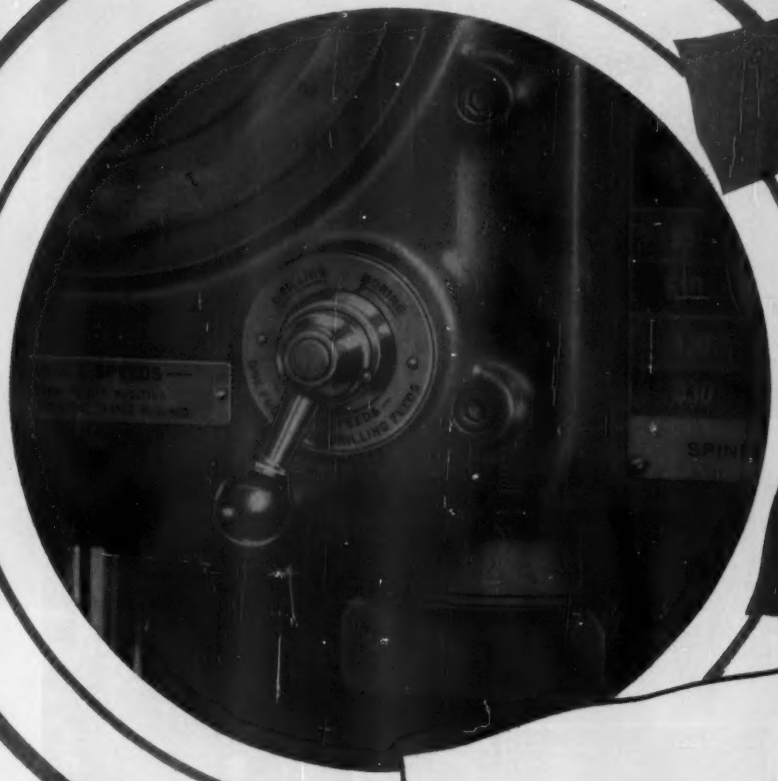
Considerable machining is required in the manufacture of parts for these taps. That's why Crucible MAX-EL® 3½ free machining alloy steel was chosen by the Geometric Tool Company, Division of Greenfield Tap and Die Corporation. For with MAX-EL you can rough machine, *then* heat treat even intricate parts before final machining *with no danger of distortion of the steel.*

But the best way to check the advantages of MAX-EL is to try it in your own shop. Like many other users you'll appreciate its superior machinability, freedom from distortion, deep hardenability characteristics, uniformity and quality. And you'll like the longer tool life you get by using MAX-EL.

For complete data . . . and *quick delivery* of MAX-EL alloy steels, from local warehouse stocks, call *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE** first name in special purpose steels

## Crucible Steel Company of America



Again...

"AMERICAN" expands the scope of Radial Drill usefulness

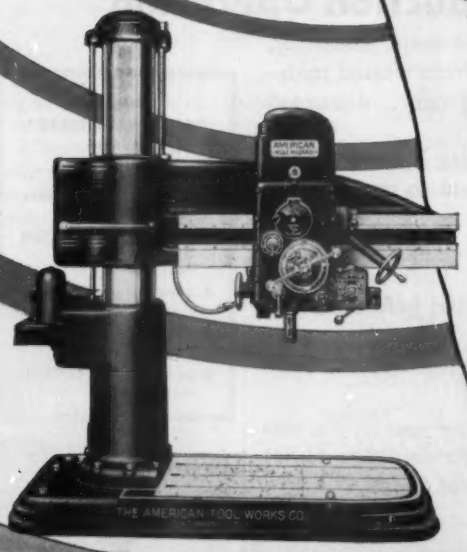
9 inch and 11 inch column "AMERICAN" HOLE Wizard Radials now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75%.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

Another *first* of great value to help radial drill users to produce more and better work at less cost.

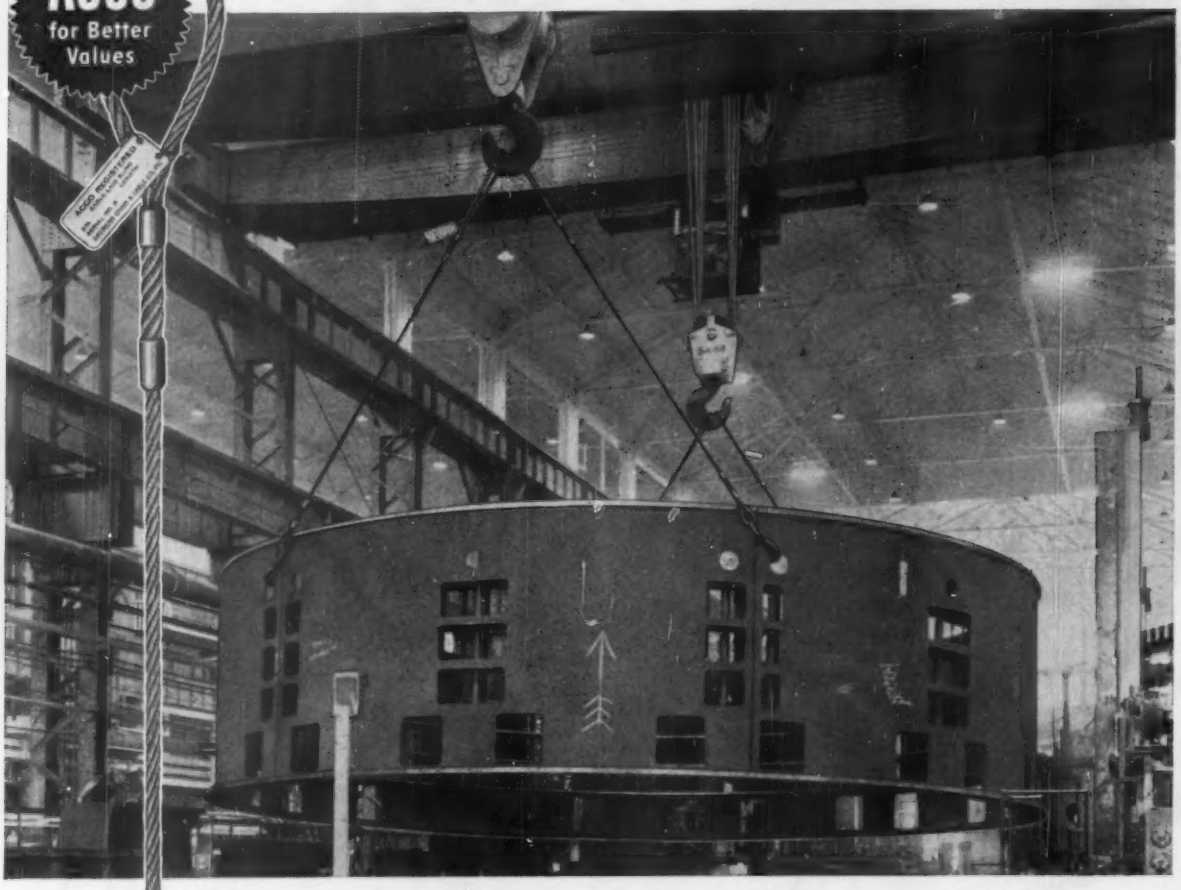
*Bulletin No. 325 tells the story.*



**THE AMERICAN TOOL WORKS CO.** Cincinnati 2, Ohio, U. S. A.

**LATHES AND RADIAL DRILLS**

# ACCO Registered® Wire Rope Slings




## Your Most Important Production Operation

...may be lifting your finished product, or a major assembly. A dropped load can result in serious losses from wasted materials and labor...damaged production equipment...disrupted delivery schedules.

The man in your plant in charge of lifting operations has a heavy responsibility. It is good management to provide him with the best possible tools for his job.

The slings he uses are vitally important. The safest slings made are ACCO *Registered* Wire Rope Slings. Each is precision made and pre-tested at twice its working load before leaving the factory.

To protect your production line, call your nearby ACCO Wire Rope Sling distributor.

**WHAT "ACCO REGISTERED" MEANS**

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification tag on each sling
6. Signed Registry Certificate with each sling

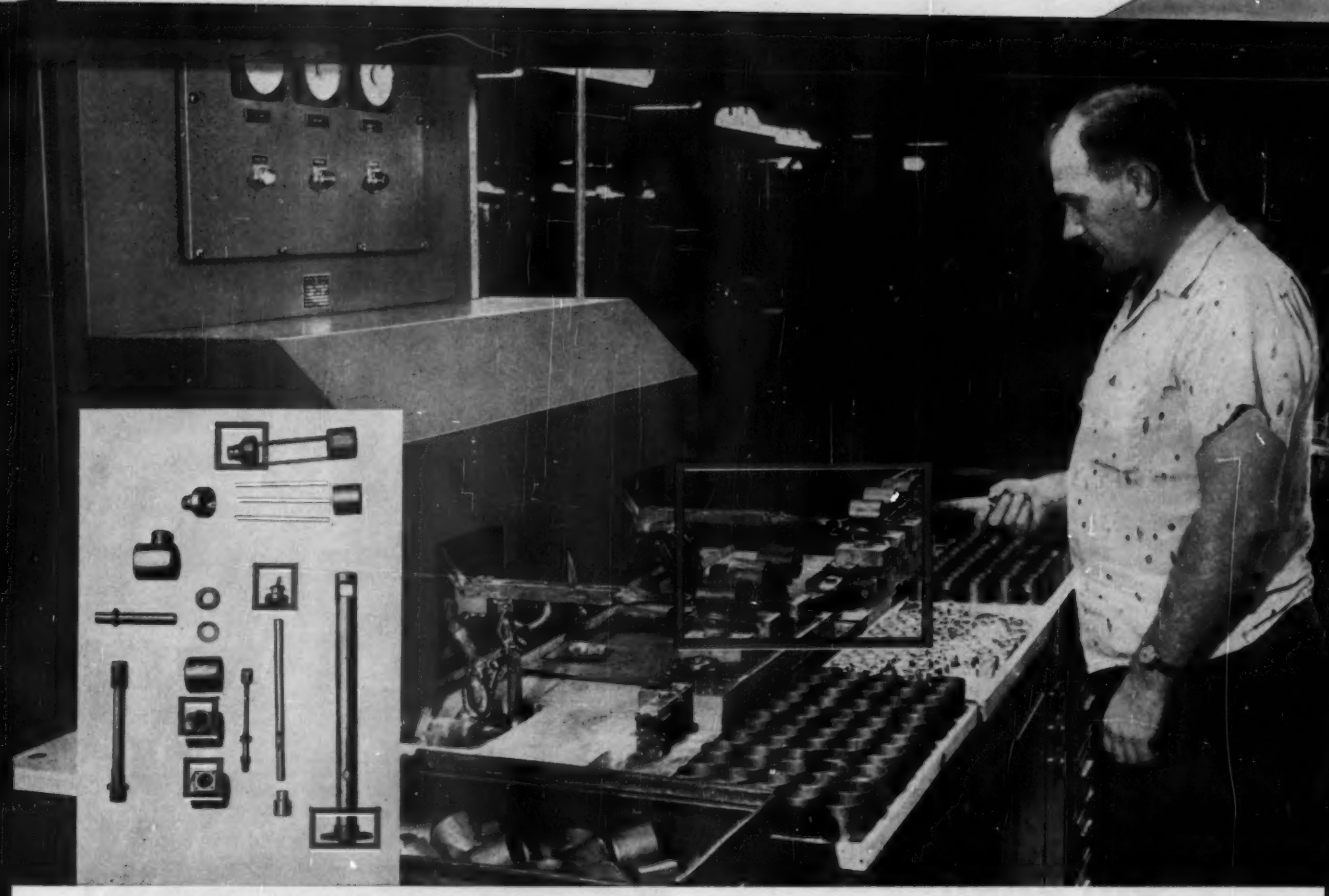
***FREE FOLDER** • Write Wilkes-Barre office for your copy of new Folder DH-532, which gives strengths and weights (for six different lifts) on a full size range of ACCO Registered Cable-Laid Slings.*

*Trade Mark Registered

**AMERICAN CHAIN & CABLE COMPANY, INC., WILKES-BARRE, PA.**

Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

In Canada: Dominion Chain Company, Ltd., Niagara Falls, Ontario



*AT HARTFORD MACHINE SCREW CO.—*

# General Electric induction heaters braze 20 different parts, help cut rejects 91%

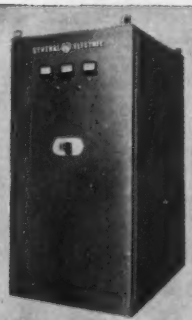
At Hartford Machine Screw Co., a General Electric electronic induction heater is used for brazing a wide variety of parts for electric-switch housings and jet engines.

The General Electric unit takes on jobs ranging from ¼-inch to 1½-inch tubing. After brazing, each part undergoes a regular 500-pound pressure test, and the aircraft work must pass radiographic inspection. With the General Electric induction heater, rejects have been reduced 91 per cent, from 30-35 per cent to a maximum of two per cent.

"If we need another induction heater, it definitely will be a General Electric," says A. O. Haversat, plant engineer. "The output control alone makes it virtually a MUST. This feature is just what we need for our kind of production. It eliminates guesswork and costly human errors. And it cuts out excess tooling, while still assuring uniform brazing."

General Electric electronic induction heaters are available in four ratings—7½-15-, 25-, and 40-kw, with a choice of four different models in each rating. The four models provide various control combinations, so you can buy the one induction heater which best matches your production pattern from the standpoint of both rating and control.

For more information, send in the coupon below or contact your nearby General Electric Apparatus Sales Office.



Four models in each of four ratings; 7½ Kw, 15 Kw, 25 Kw, and 40 Kw.

General Electric Co.
Section 722-6
Schenectady, N. Y.

PLEASE SEND ME A COPY OF BULLETIN GEA-6388

NAME_____

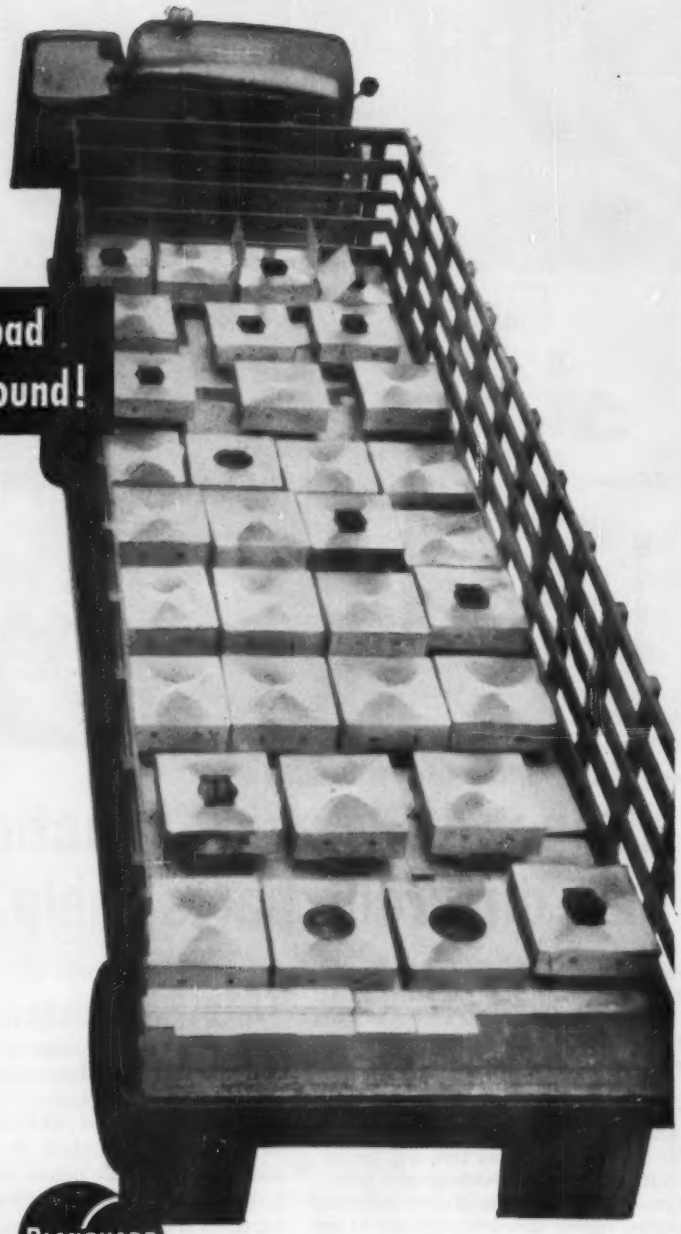
COMPANY_____

STREET_____

CITY_____ STATE_____

GENERAL ELECTRIC

# Precision by the Truckload - - they're Blanchard ground!



This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

*Ask for details on the 15 standard Blanchard models.*

For best results in surface grinding . . .

**PUT IT ON THE BLANCHARD**

**THE BLANCHARD MACHINE COMPANY** 64 STATE ST., CAMBRIDGE 39, MASS.

THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

*Gentlemen:* Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

# Production turning at 1/2 the cost!

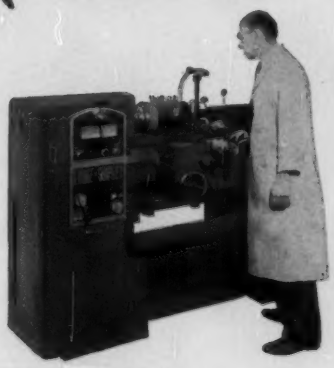
***Lodge & Shipley 10″ HI-TURN Production Lathe does job of really big lathe***

...and completely outperforms any other 10″ lathe!

BIG in power and production . . . BIG in speed, in rugged construction and accuracy, the Lodge & Shipley 10″ HI-TURN Production Lathe costs only ½ the price of a good 13″ lathe used for comparable work. Here are a few of the many features that put the 10″ HI-TURN in the big lathe, big value class and put it 'way ahead of *any* 10″ lathe:

| FEATURE | Lodge & Shipley 10″ HI-TURN | Lathe B | Lathe C |
|---|---|---|---|
| **HEADSTOCK** | | | |
| Full 5 horsepower | yes | | |
| 200 to 3000 r.p.m. | yes | | |
| All spur gear drive | yes | | |
| Swing over bed | 13¼″ | | |
| Spindle speeds | 9 | | |
| **BED** | | | |
| Width of bed | 11⅜″ | | |
| Depth of bed | 11⅝″ | | |
| Hardened, ground, replaceable bedways | yes | | |
| **QUICK CHANGE GEAR BOX** | | | |
| Number of quick change feeds | 9 | | |
| Range of Feeds, thous. per rev. | 1.5 to 24 | | |
| **CARRIAGE** | | | |
| Carriage length | 19⅛″ | | |
| Carriage bridge width | 5⅞″ | | |
| Cross slide travel | 6¾″ | | |
| Flame-hardened and ground cross slide ways | yes | | |
| **TAILSTOCK** | | | |
| Tailstock spindle diameter | 2⅛″ | | |
| Tailstock spindle travel | 4½″ | | |
| **MISCELLANEOUS** | | | |
| Size of lathe tool | ¾″ x ¾″ | | |
| Net weight, base machine | 3400 lbs. | | |
| Template type length stops | yes | | |

**You make the comparison** *with any 10″ lathe*

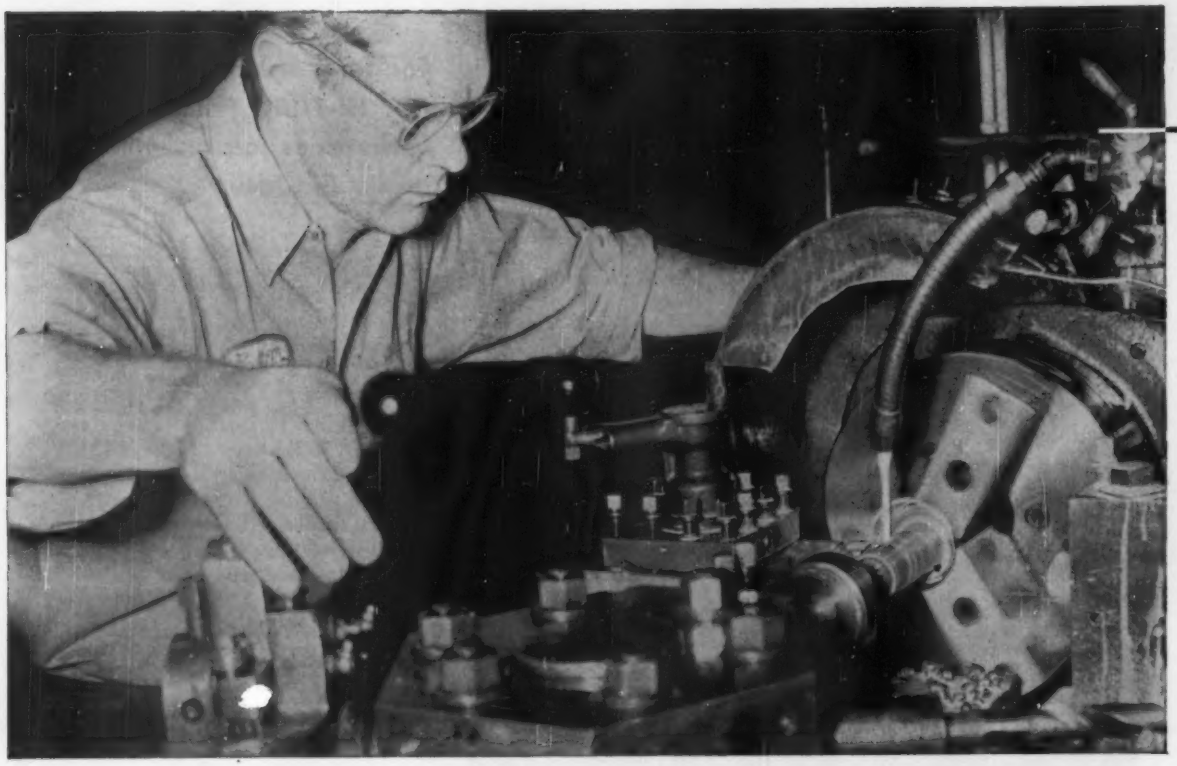


Compare the Lodge & Shipley 10″ HI-TURN Production Lathe with *any other* 10″ lathe . . . even with 13″ lathes. If you don't need additional thread chasing facilities, it's the lathe for you!

Get complete details now. Write: The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

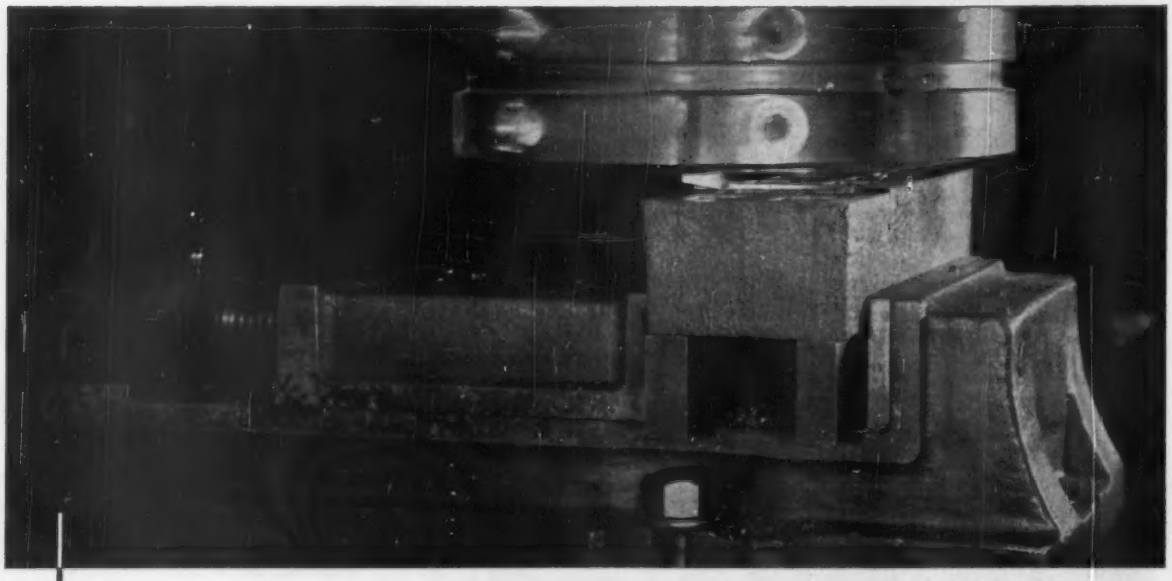
Your Lodge-ical Choice for low-cost high-production

**Lodge & Shipley**



On any material, any job . . .

# INCREASE PRODUCTIVITY, CUT UNIT



**Output boosted 20%-30% with Grade 860**

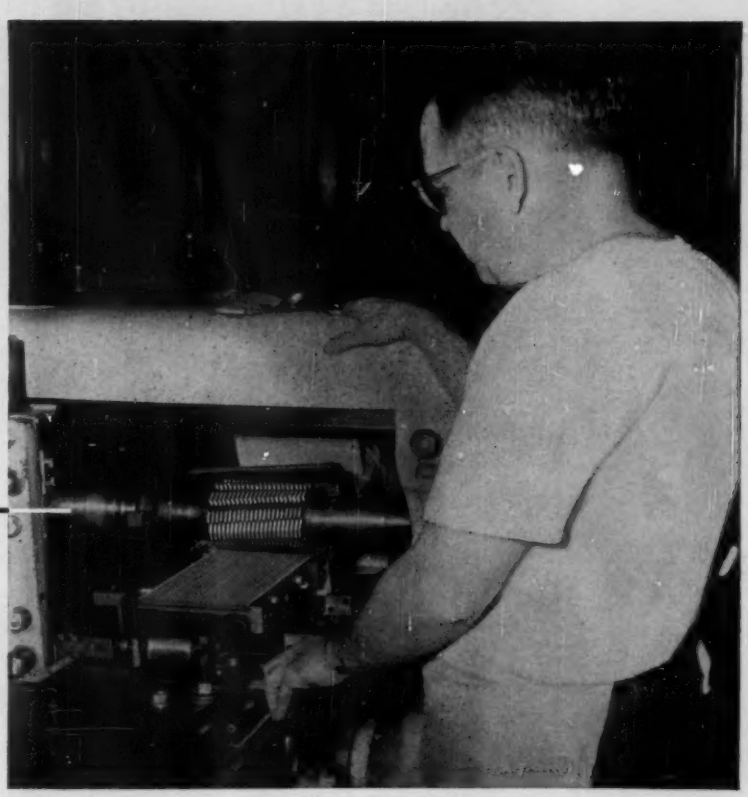
**Milling gray cast iron.** Cemented carbide increased production, yet provided longer tool life, better finishes on the new hard, dense types of gray cast iron. Tests on simulated engine blocks (above) showed Grade 860 took interrupted cuts with minute wear, no chipping . . . while other carbides showed extensive chipping and cratering.

**Production rate doubled with Grade 370 tool**

**Turning 4340 steel.** High-impact cutting involved on this special aircraft shaft caused rapid dulling of conventional carbides; several work stoppages per shaft occurred while tools were reground. Today, Synchro Devices, Inc., turns a complete shaft with a single Grade 370 tool . . . also gets double the production.

**Daily regrinding ended by Grade 883 cutters**

**Gang-milling plastics.** Cotton-impregnated plastic-like plugboards were so abrasive that steel cutters were down for costly, time-consuming regrinding almost daily. Switching to Carboloy Grade 883, International Business Machines Corp. milled 900,000 boards with the carbide-tipped cutters without sharpening.



# COSTS WITH CARBOLOY® CARBIDES

- Take heavier cuts, at faster speeds and feeds
- Lower tool cost per piece, boost machine efficiency

Whether you're cutting steel, cast iron, aluminum—or even nonmetallics like plastics—Carboloy carbide grades will keep machines running longer at top efficiency.

Carboloy cemented carbides make your machines more productive because they take greater speeds and feeds . . . give you more output per grind. And, they'll cut unit costs through lower downtime, grinding, and maintenance costs . . . give you more production per tool. It adds up to a more efficient – and therefore, more profitable – machining operation.

**Wide choice of grades**

If you're cutting steel, for example, use Carboloy Extra-Performance Grades 350 and 370. These grades have proved their superiority over conventional carbides in hundreds of applications . . . doubling and tripling production in many cases.

If you're milling high-tensile cast irons, there's Carboloy Grade 860. This carbide provides greater resistance to chipping and cratering. Tests show it can increase production 20%-30%.

Or, if you're machining nonferrous materials like aluminum, brass, bronze, or titanium, you can choose from five Carboloy cemented carbides . . . and get the specific cutting characteristics you need for any job from precision finishing to heavy-duty interrupted cuts.

**Broad range of products**

Carboloy cemented carbides are locally stocked for immediate delivery by 139 Authorized Carboloy Distributors. They're available in the widest choice of styles and sizes in the industry.

Call your Distributor today (he's listed in the Yellow Pages). Or, send for a copy of Catalog GT-316, containing the new Grade Selection Guide for Carboloy cemented carbides. Write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Blvd., Detroit 32, Michigan.*

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

Resistance welding machine is operated by a two-button start-stop station and two heavy-duty stations with mushroom-head buttons.

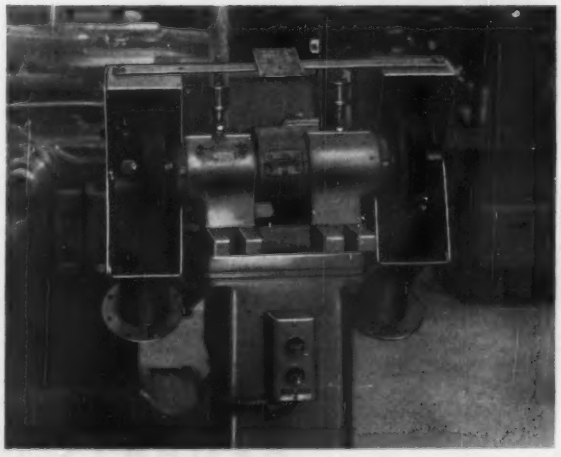
# Two ways General Electric pushbuttons save you valuable production time

**FAST DELIVERY.** You can save valuable production time by using General Electric standard- or heavy-duty pushbuttons because G-E distributors keep a complete stock of these stations. You can get the forms you want, when you want, simply by calling your General Electric distributor.

**DEPENDABLE OPERATION.** Once installed, General Electric pushbuttons save you more production time because they are built for dependable service. Durable enclosures are made of steel for strength and safety. Large silver contacts are designed for long life. Good contact is provided by strong button springs which reduce chance of contact freezing.

Standard-duty pushbuttons are available in 1 to 3 unit stations, heavy-duty push buttons in 1 to 6 unit stations. Contact your nearest G-E distributor for more information, or write advertising Section 733–29, General Electric Co., Bloomington, Ill. Ask for bulletin GEA-6544, "Standard- and Heavy-duty Pushbuttons."

GENERAL ELECTRIC

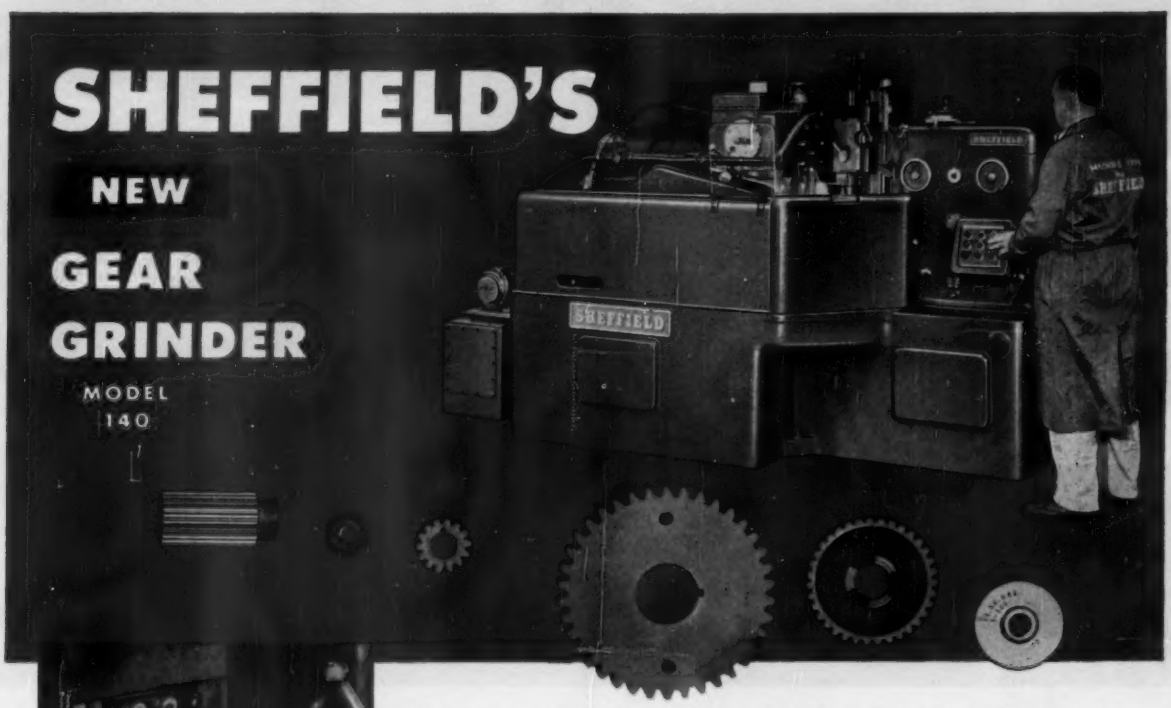


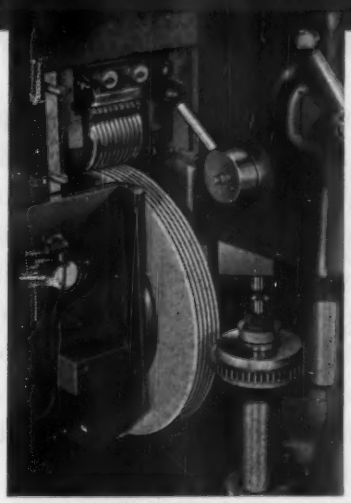
General Electric standard-duty pushbutton station provides economical and dependable start-stop operation as on the grinder above.

# *High-Precision Gear Production*

# INCREASED 300% *on*

## SHEFFIELD'S NEW GEAR GRINDER MODEL 140



*Relationship of crushing roll, grinding wheel and work part.*

Precision gears for aircraft, fire control, servo mechanisms, guided missiles, transmissions and machine tools may be ground to a total composite error of less .0005" at production rates three times faster than heretofore possible.

The secret is a fast-cutting grinding wheel accurately crushtrued to the basic rack form, operated like a hob and with the work rotating as the teeth are ground—either from the solid hardened blank or a preformed gear.

FIELD REPORTS—An aircraft engine manufacturer says "Gears ground on the Model 140 Grinder have passed our surface tempering inspection and show no grinding burns".

A large precision instrument manufacturer, in speaking of the Model 140, writes, "We have inspected gears ground on prominent gear grinders of both American and European manufacture. Our findings have revealed that this machine is by far the most accurate to date."

**MACHINE CAPACITY (Work Gear)**

| | | | |
|---|---|---|---|
| Outside Diameter | Up to 8" | Pitch | 8 to 100 |
| Face Width | Up to 5" | Helix Angle | Up to 45° |
| Distance between centers | 15" | | |

**For complete information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.**

7656

*the* SHEFFIELD *corporation*

...urement for mankind

# Find out whether this new machine will bore your parts 3 to 8 times faster!

**Parts with long holes . . . or identical parts,**

*The new LeBlond-Carlstedt Rapid Borers* solid bore, trepan or counterbore holes 3 to 8 times faster than by the conventional D-bit method! *Hole capacity from 5/16" to 4-1/4" diameter.* Basically, the Rapid Borer is suited to work that is symmetrical for balance in rotation—round, square, octagonal, tapered or stepped. A wide variety of hole diameters and depths as well as work sizes can be handled.

The Rapid Borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with good accuracy and finish. Cutting oil at high pressure is forced between the boring bar and hole wall forming a continuous bearing. It flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and proper feed and speed combinations; thus tool faces are kept clean and chip passage clear. Cutter design produces balanced cutting pressures thereby controlling concentricity.

This new tooling requires a machine with the following characteristics, all of which are incorporated in the LeBlond Rapid Borer design—High spindle horsepower; Ample rigidity throughout; Complete absence of vibration at all speeds; Infinitely-variable feeds, independent of speeds, while running under load; Final drive to spindle through belts; Large volume of cutting oil. Available in 3 sizes, No. 15, No. 30 and No. 60.

*Tell us about the holes you'd like to produce faster.* Large holes or small. If the Rapid Borer can handle the job, we'll show you how to produce them faster than ever before. Other equipment available for holes larger than 4¼".

THE R. K. LEBLOND MACHINE TOOL COMPANY
Dept. A, Cincinnati 8, Ohio

Gentlemen:
We want to know if your Rapid Borer really will bore our part 3 to 8 times faster. Here's a description of the job.

*Size of hole to be bored* _____

*Length of hole to be bored* _____

*Annual production of parts* _____

*Material and Hardness* _____

*Conformation of part and dimensions (send sketch or print)*

Name _____

Title _____

Company _____

Address _____

City _____ State _____

**bored as one piece, then cut apart.**

*These tremendous production savings can be yours!*

Rapid Borer Time: 5.2 minutes
D-Bit Time (old method): 41.5 minutes
*Hole diameter . . . 1-17/32"*
*Hole length . . . 31¼"*
*Part material . . . C-1141 Hot Rolled 187 Brinell*
*Part outside diameter . . . 2.450" at small end, 2.710" at large end.*
*Feed rate (solid bore) . . . 6" per minute*

Rapid Borer Time: 17.75 minutes
D-Bit Time (old method): 86 minutes
*Hole diameter . . . 2-3/16" Core diameter . . . .852"*
*Hole length . . . 53¾"*
*Part material . . . 4140 Forging 200 Brinell*
*Part outside diameter . . . 3.455" at small end, 4.425" at large end.*
*Feed rate (trepanning) . . . 3" per minute*

For complete information write for Bulletin LC 501A

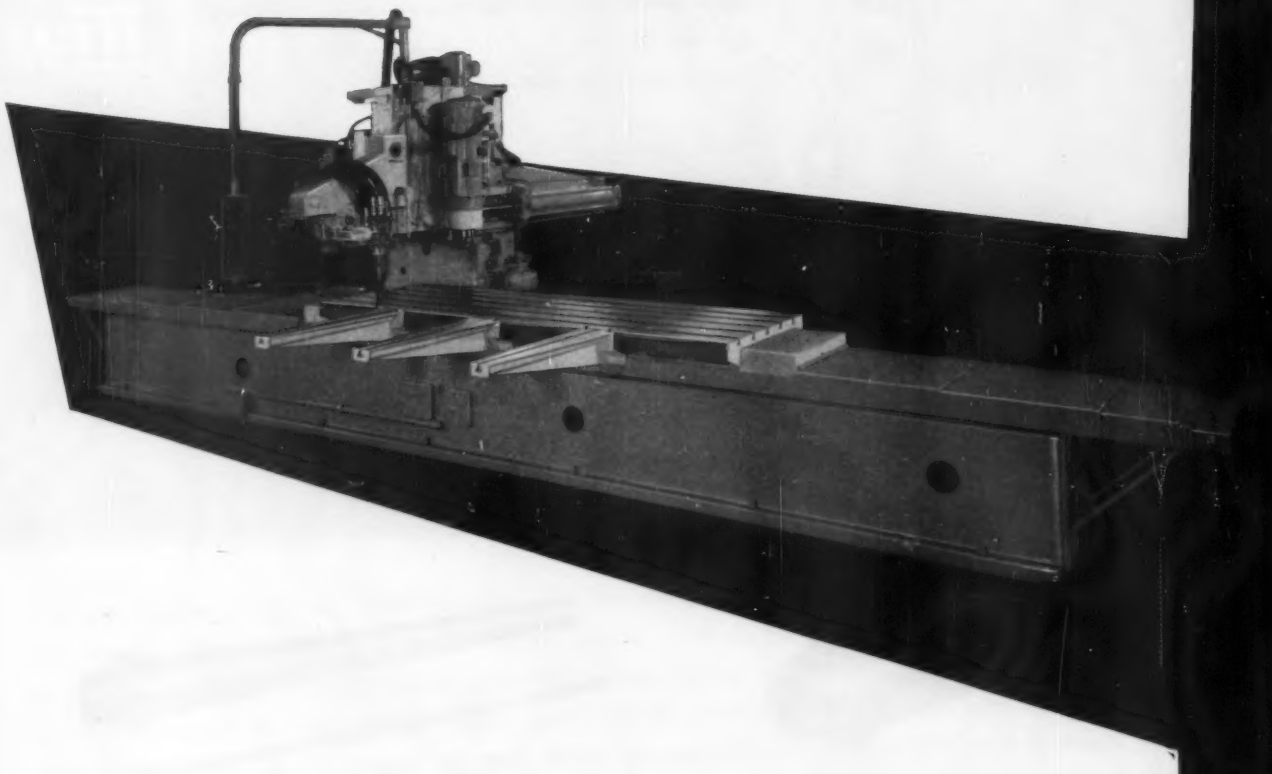
**THE R.K.LeBLOND MACHINE TOOL COMPANY**

Cincinnati 8, Ohio

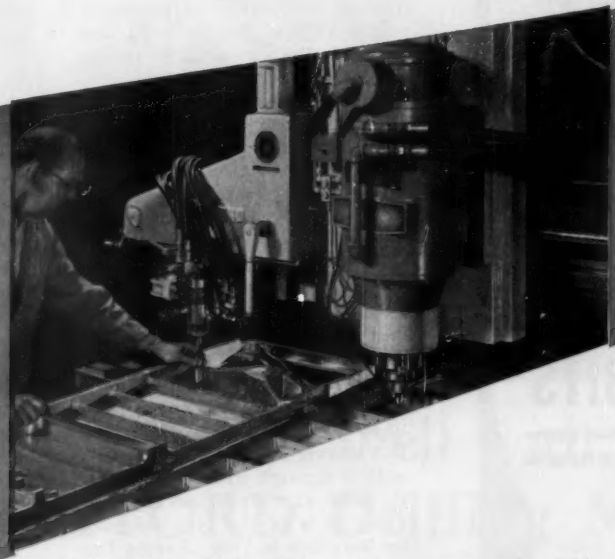
World's Largest Builder of a Complete Line of Lathes for more than 70 years

LeBLOND of Cincinnati

**new** hydraulic planer-type **air-frame mill**



# for fast, high-precision machining of aluminum air-frame parts



Specifically designed for fast, high-precision machining of variable and complex, 3-dimensional shapes, this new air-frame mill speeds the machining of aluminum air-frame parts. Equipped with a highly sensitive, 3-dimensional hydraulic tracer valve for contour work, the machine also has a depth control valve for 360° tracing. Machining is traced from wood, plastic, metal, plaster of paris models, or actual parts. Available in sizes to 36" x 36" x 10 feet.

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# Letters...

To American Machinist
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## Monuments

Dear Sirs:

The fine compliment in the letter from Oliver Broadbent of Coventry, England (*AM*—Oct 22, '56, p98) has just been called to my attention. At first glance I thought it referred to my father for he was indeed a renowned authority on precision. But it specifies ultra-precise dividing, so it is clearly aimed at me. I'm flattered and grateful. I'm also grateful for his suggestion that the Editor step up punctuation of long decimals, which suggestion I gladly note that the Editor seems increasingly to follow.

Especially interesting is Broadbent's note about the Watts dividing engine. Months ago, at the time of Mr Watts' death, I received a printed note from Hilger & Watts stating the gracious sentiment and obvious truth that this dividing engine will serve as a lasting monument to Mr Watts.

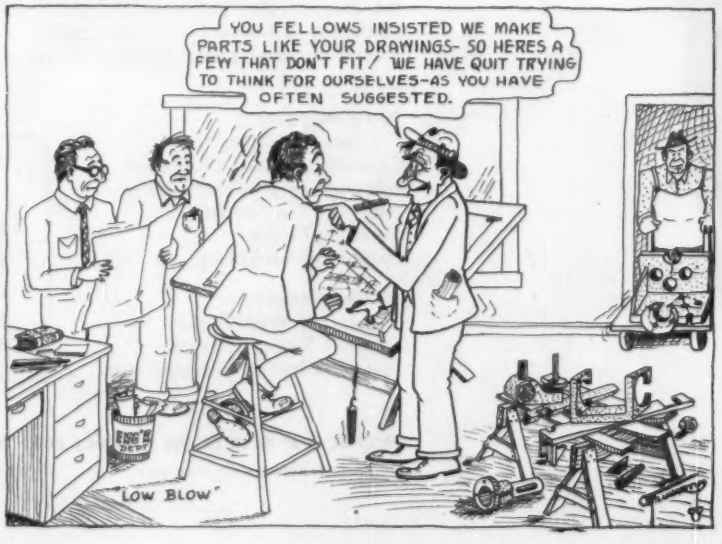
The Watts engine is one of those in Europe which I have not seen. But I have vicarious acquaintance with it through circles divided on it. Like all current dividing engines, it is of the type invented by Ramsden in 1768. Having limitations inherent in this type, it isn't the kind capable of rapid, *commercial* production of *ultra*-precise circles where the limit of error is *less than ½ arc-sec*. Even so, it produces circles accurate to about 1 arc-sec. That's close to the limit of accuracy possible in automatically producing circles with this type of engine. And, as Broadbent says, it is thus "one of the outstanding dividing engines of *high* precision."

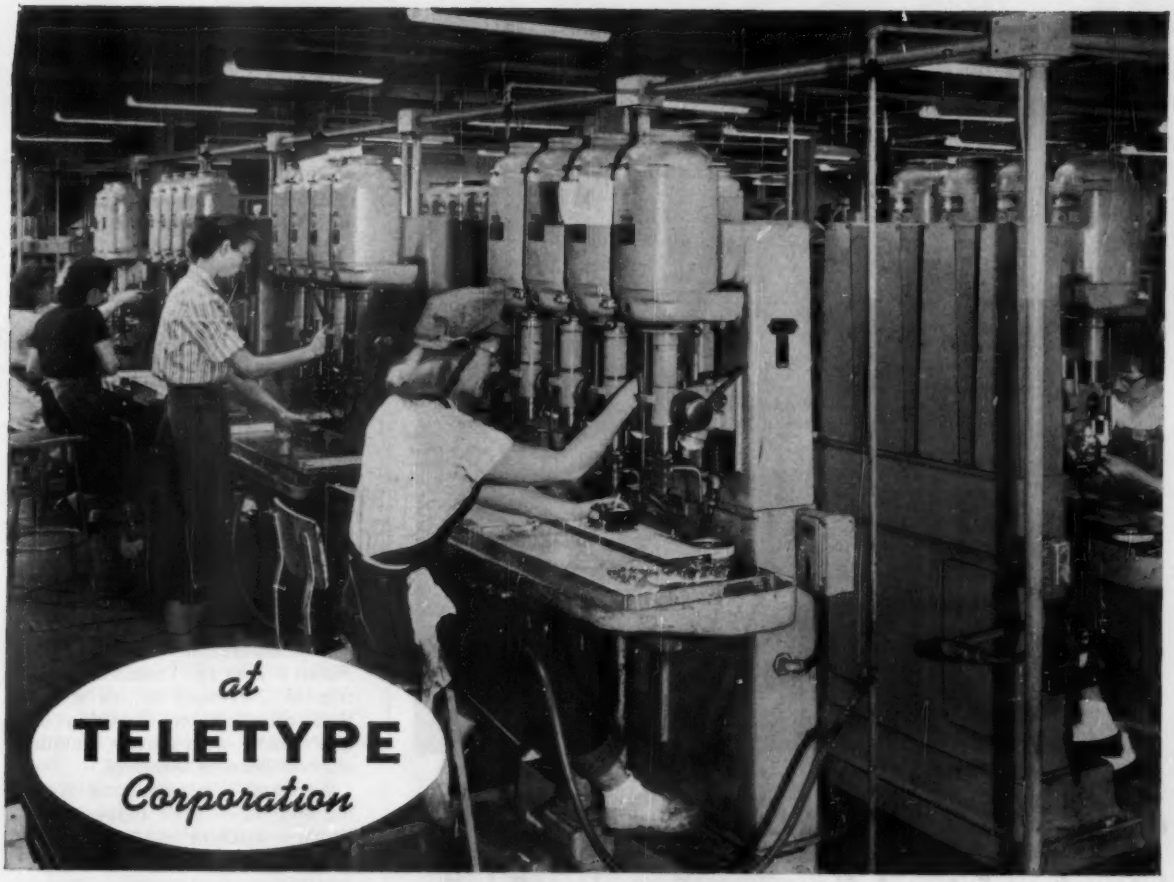
Consider for a moment a machine—with the Ramsden limitations—holding to this *production* tolerance of 1 arc-sec. It means mechanically graduating a 2-in. circle (like those in many European optical theodolites) to a tolerance of only 0.000,004,8 in.—just a "hair" (!) under five millionths—along the edge of the circle.

A machine capable of doing that automatically is a stately monument indeed to the man responsible for its building — especially so, considering the Ramsden limitations. Its construction is a task far more difficult, tedious, and time-consuming than it is to build machines capable of producing gage blocks which are parallel and of a specified thick-

## SHOPMATES

*N. Jarvis*


YOU FELLOWS INSISTED WE MAKE PARTS LIKE YOUR DRAWINGS- SO HERES A FEW THAT DON'T FIT/ WE HAVE QUIT TRYING TO THINK FOR OURSELVES-AS YOU HAVE OFTEN SUGGESTED.
"LOW BLOW"

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Thousands of small precision parts for intricate Teletype machines require a wide variety of precision drilling operations — drilling through or to depth, tapping, countersinking, spot facing.

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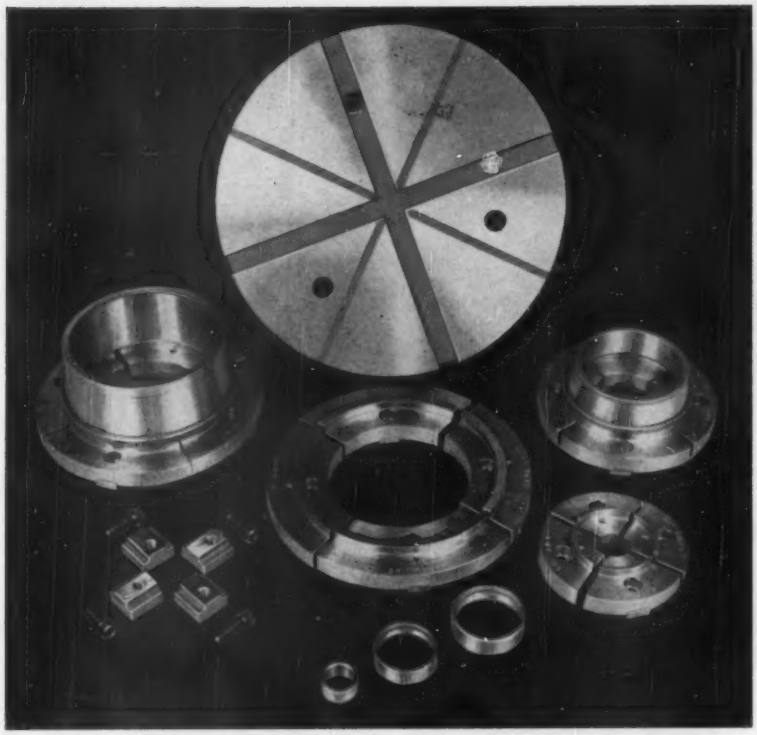

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ness to the nearest 0.000,001 in. —a *single* millionth—and with surface finish aprroaching a perfect, theoretical plane within an almost inconceivable *fraction* (mere hundredths) of a millionth. (It's easier and clearer to say it that way than to write the figure with the required string of zeros, even with punctuation.)

Operation of both machines is automatic. No "hand finishing." But in setup and operating requirements, the dividing engine imposes far more restrictions than the gage machine.

Broadbent presumably is acquainted with the fact that here in the U S we also have at least one such monument in the form of a highly precise Ramsden-type dividing engine. This is at the Warner & Swasey plant. It is a monument to Ambrose Swasey who was most responsible for its building, early in the 'Nineties, a decade before the Watts machine. About a year ago I made a special trip to Cleveland to see it and thus complete my "talking acquaintance" with precise dividing engines here in America.

As usual in constructing dividing engines — even today — the Swasey machine was a number of years abuilding. It was an astonishing accomplishment; it was built from scratch. Swasey had to devise and develop, improvise and substitute—in methods *and* materials *and* tools. It was in the days when, in the words of J H Van Deventer, almost literally "steel was only of two kinds: that used to make things of, and the

## Helpful Henry

*by L. Hoppes*

*"Your wife's at the gate waiting for your check. Asked if you'd got paid today, and I told her you had!"*

kind to make things with." Swasey had none of the advantages rendered by modern machine tools. He probably had no advantage of an existing high-precision circle to start with. But when it was finished, it certainly was the world's most precise dividing engine. And it probably remains today, 60 years later, America's most precise Ramsden machine.

It is at least comparable in production accuracy with the Zeiss engine which the Russians "lifted" from Jena, Germany in 1945. In 1936 the man at the Zeiss plant responsible for the latter machine told me that it produced circles with error-limit of 0.6 arc-sec. Such still doesn't insure reliability of "the *nearest* single arc-sec" in circles produced, which requires the super-precision defined above. But it is mighty precise.

As far as I know, from extensive work geodetic people have done with theodolites containing them, those Zeiss circles are about the most precise that have been made in anything like production quantities. Moreover, my calculations suggest that 0.6 arc-sec is about as accurate as may ever be attained in automatic dividing in Ramsden-type engines because of the inherent limitations mentioned.

These considerations suggest the great magnitude of what Swasey achieved. Incidentally, Warner & Swasey and its staff deserve a handsome compliment for the care with which they preserve and use it. I am the more impressed because I know of other installations where the opposite is true. I know of one other fine engine that could not possibly produce anything but rough work compared with what it would produce if properly installed.

Although probably not quite so precise, we also have here in the U S some other worthy monuments of this kind. Among them may be mentioned the Ainsworth dividing engine in Denver and David Mann's in Lincoln, Mass. My hat's off to these, and to Watts, and Swasey, and all other builders of such useful monuments! And my thanks to Broadbent for giving me the opportunity to write these few words about them.

Lew Suverkrop, ME
*Bakersfield, Calif.*


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## You Need Most

**Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13"... in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.**

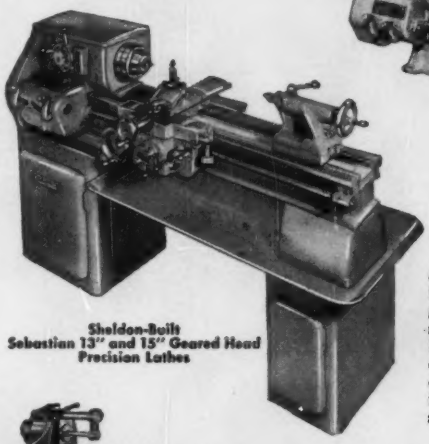
**Powerful, all-V-belt, drive units – either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.**

**All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).**

**Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.**

**UM-56 P 13" Swing Precision Lathe**

**No. L-46 Sheldon 10" Precision Lathe**



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**The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.**

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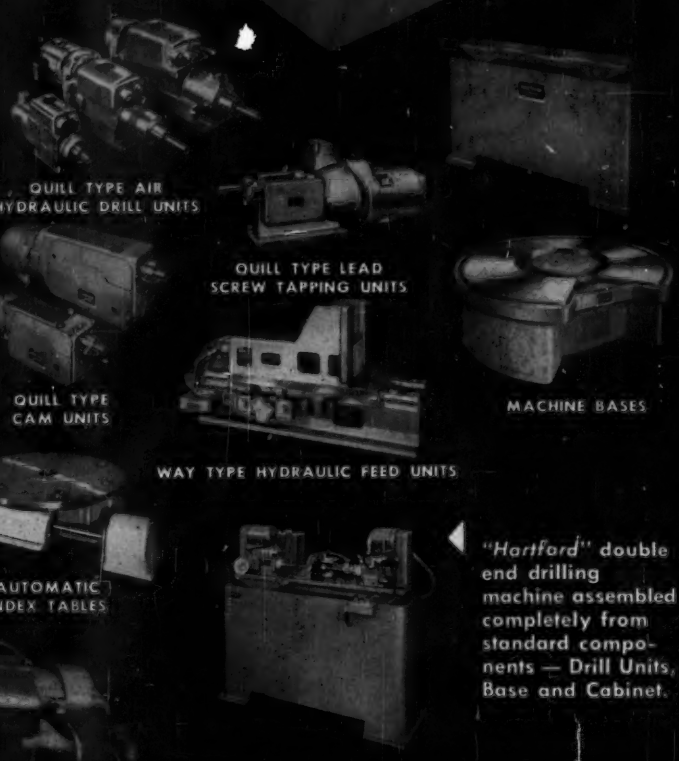

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AUTOMATIC INDEX TABLES

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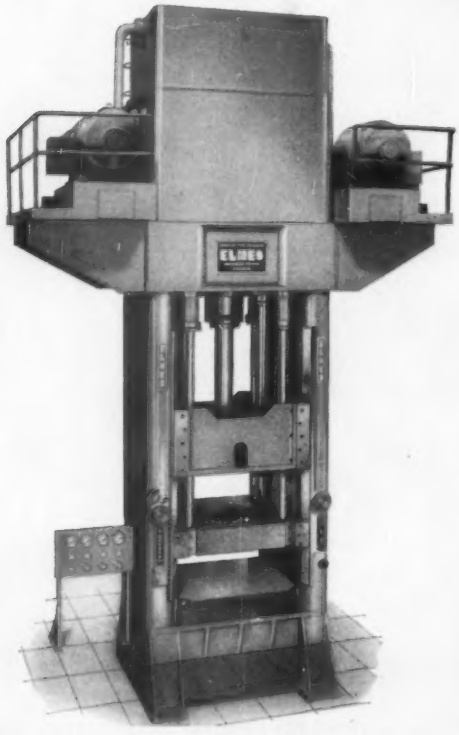

Those tough production problems that require something extra in drawing, forming, bending, hobbing, forging or other press performance are just the kind that Elmes engineers like to be called in on. More than 60 years in the specialized field of hydraulics has built the Elmes reputation for recommending and supplying hydraulic presses that are "job-fitted" for profit-making performance, no matter how special the job.

While a wide range of standard Elmes Press designs meet all usual requirements in drawing, forming and other press work, the development of special presses "job-fitted" to the customer's exact requirements is a major part of Elmes engineering service. Whatever your pressing problem, it will pay you to call in Elmes for consultation and recommendations. Distributors in principal cities.

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# Spot news...

- **Machinery industry will require 32% more scientists and engineers,** and the electrical machinery industry 29% more, in the 1957-1960 period than in 1956, McGraw-Hill Economics Department survey discloses. Manufacturing companies as a whole expect to employ 7% more scientists this year than last, and an added 15% by 1960.

- **Introduction of Mercedes-Benz cars here by Studebaker-Packard this month** may also be the opening wedge in introducing German tooling to U.S basic industry. Curtiss-Wright, which is managing S-P, not only will use German tooling for the Mercedes line, assembling the cars in this country, it is seriously thinking of soliciting tooling orders in the U S and farming them out via Daimler-Benz in Germany for completion.

- **Britain is going into production on three new guided missiles.** DeHavilland will build an air-to-air infra-red missile; Bristol Aeroplane will make a surface-to-air ramjet missile; and English Electric Co will make a rocket-powered surface-to-air missile designed to reach great heights.

- **First successful spinning of thick titanium alloy hemispheres** by methods suitable for production quantities is claimed by Titanium Fabricators Inc, Burbank, Calif. First use of TFI's horizontal spinning machine is for production of Ti alloy hemispheres with 25-15 in. dia, and with gage thicknesses in excess of ¼ in., using inexpensive dies.

- **A 22-million-volt betatron that makes radiographs of 20-in.-thick metal** is being installed by Electric Steel Foundry Co, Portland, Ore. Built by Allis-Chalmers, this is the first such unit with ceiling-mounted telescope tubing which travels 4 ft vertically, with 20 ft of horizontal dolly travel.

- **Manufacture of small jet transports** will shortly be announced by Lockheed Aircraft's Georgia Division, Marietta, Ga.

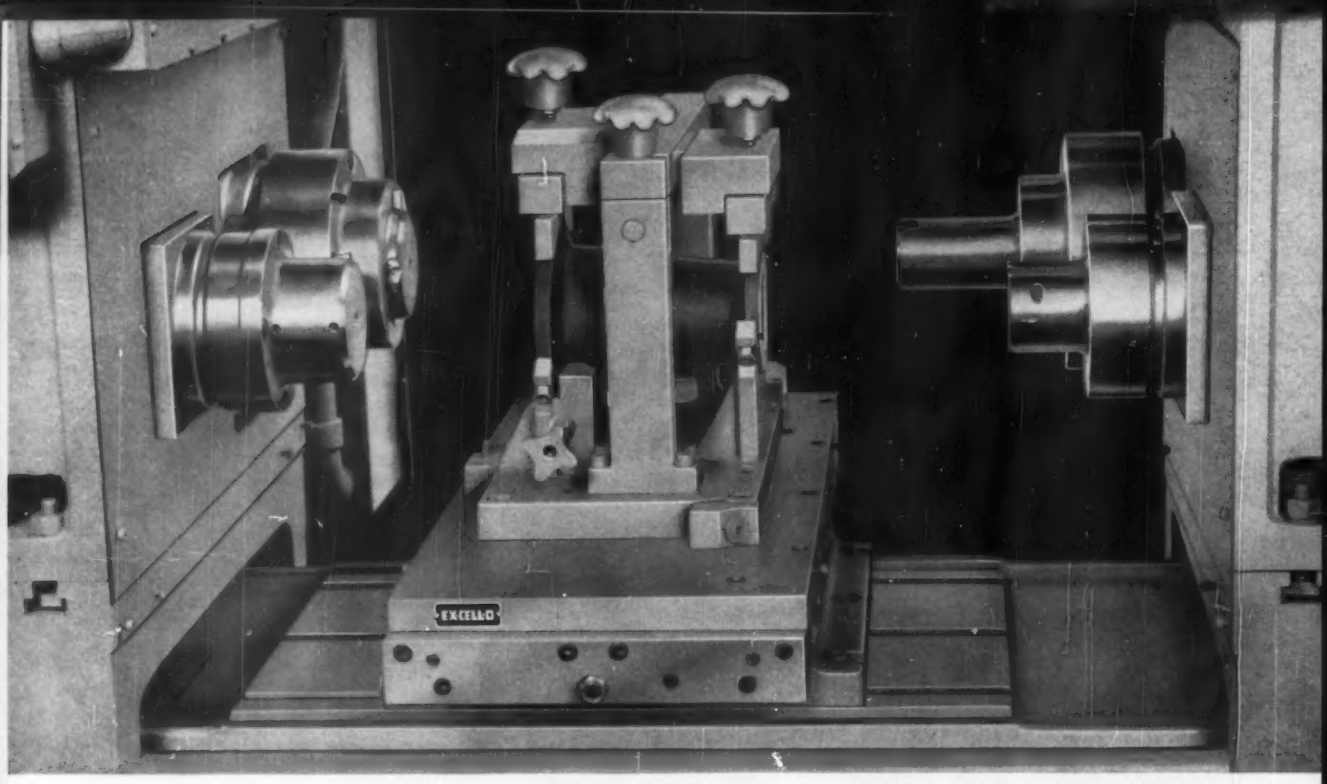
- **Electrolytic method of descaling titanium** is reportedly saving Temco Aircraft $5000 a month in parts rejects. Process, which can be done by one man instead of eight hand scrubbers, etches Ti evenly, leaves it with a smooth natural surface. No expensive heating equipment is required.

- **Canadian process for selective-area plating** makes it possible to deposit almost any metal on another metal in finely controllable thicknesses, is so simple that even visitors at a trade show were allowed to do it themselves.

- **Instrument that can measure 0.001-in. paint, electroplating or metal overlay** has been developed by GM's research staff. The "Lamingage" can be plugged into any 110-volt outlet, requires no special training to operate it. Probing coil instantaneously "reports" thickness of coating under test.

## Spot index to major News stories...


Metalworking Plans Huge Outlays for New Plant and Equipment 1957-1960 ..... 162
Milling Plane Parts with Tape Controls ..... 166
How Russia Mass-Produces Engineers ..... 168
Halting "Galloping Obsolescence" ..... 171
Washington ..... 99
Detroit ..... 101
Machine Tools .... 103
What's Ahead in Metalworking 107
in Business ..... 108
Gaging Surplus Machinery ..... 284




One of several fixture arrangements used for machining valve parts.

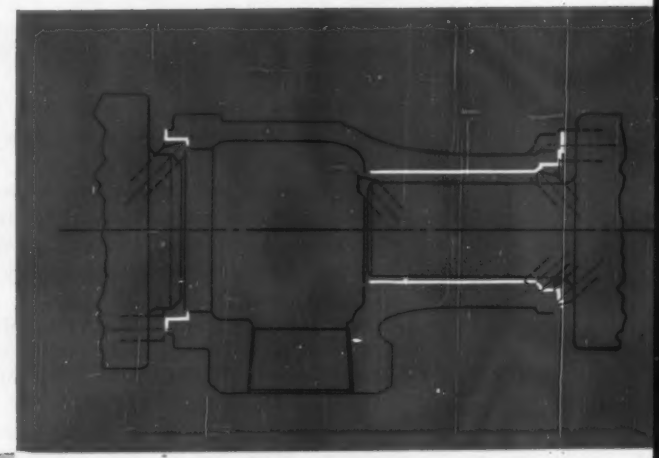
# Fast and Flexible

## SHORT RUN COST SAVER . . .

This Ex-Cell-O 17-A Precision Boring Machine rough bores, plunge faces, finish bores and chamfers a wide range of assorted cast-iron valve bodies and bases. Production schedules require relatively short runs of each size, so the tooling shown here has set blocks to accommodate the various parts.

Designed for medium and large size workpieces, the double-end 17-A Precision Boring Machine can handle identical operations at either end; rough at one end, finish at the other; or perform an entirely different operation at each end. So you can see the cost-saving versatility of this two-in-one machine.

Perhaps slow changeovers are inflating your production costs. If so, why not call your Ex-Cell-O Representative or contact Ex-Cell-O in Detroit.



White lines represent cuts made on a typical part.

Here are a few sizes of the valve bodies and bases processed on the Style 17-A Machine.

**EX-CELL-O CORPORATION** — *Machinery Division*

DETROIT 32, MICHIGAN

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57-22

# Washington ... NEWS REPORT

## Leading defense contractors . . .

The growing concentration of defense production among fewer and larger producers of planes, missiles, and electronics shows up in the latest Pentagon listing of top United States military contractors.

**Excluding GM and Ford,** each of the 20 leading contractors for both the latest report period (Jan 1955-June 1956) and the cumulative July 1950-June 1956 period are aircraft or electronics companies. And both GM and Ford rank high as suppliers of aircraft and missile systems rather than of automotive equipment.

**On a cumulative basis since Korea,** GM, Boeing, United Aircraft, GE, Douglas, North American, General Dynamics, Lockheed, AT&T and Curtiss-Wright—the total making up 31.5% of all awards—are the top 10. Leading the pack with most contracts in the latest 18-month period are North American, General Dynamics, United Aircraft, GE, Boeing, AT&T, Ford, Lockheed, Douglas and McDonnell Aircraft—accounting for 36% of prime contracts awarded during the period.

## Military spending boost . . .

Over three-fourths of the $1.8 billion federal surplus expected this year is being wiped out by a new boost in military spending. Defense Dept now officially concedes that fiscal 1957 military expenditures will hit $38 billion—$2 billion more than initially estimated. The outlook is that the $38 billion figure still estimated for next year will also be topped by actual expenditures.

**Big factor in the defense cost hike** is ballooning expenses for the Long-Range Ballistic Missile Program, now running on a "crash" basis. Total costs will probably be over $1 billion this year.

**Other factors:** continuing boosts in material prices and wages—which military suppliers recover under most types of contracts; cuts in production lead-times for certain planes, bringing deliveries and federal cash outlays up a few months; more advance payments required by contractors hurt by tight money.

## Six-month stretchout on B-52's . . .

The Air Force plans to stretch out production of Boeing's B-52 heavy jet bomber up to six months longer than originally planned. New plans call for holding output at current rate of 15 planes a month rather than go to 20. But total fiscal 1958 production remains the same, 101 aircraft.

**Main reasons for the stretch-out:** (1) to keep B-52 lines active until decisions are made whether to order more of the planes (603 are now on order) and when to start large-scale output of the supersonic, medium-range Convair B-58 bomber; (2) to incorporate a lighter, more powerful model J-57 engine into still more B-52 jet bombers.

**Right now,** USAF plans to order 18 B-58's for evaluation tests next year. Thirteen have already been delivered or are on order. USAF says "A considerable part of the B-58's development cost" (the total is probably close to $1 billion) has been spent to build up production capacity, that new plant and equipment costs will depend on a production rate still to be set.

**New details listed by USAF** show that of the $5.5 billion earmarked for aircraft production, $2.7 billion will cover "fly-away costs" of 1515 new planes; the remainder covers costs for development of new aircraft (prototypes, etc), for spare parts, and production facilities. In addition to the 101 B-52's and 18 B-58's, USAF will order 700 fighter planes—the McDonnell F-101, Convair's F-102 and F-106, Republic's F-105; 215 Boeing KC-135 jet tankers and other transports; and 480 training aircraft.

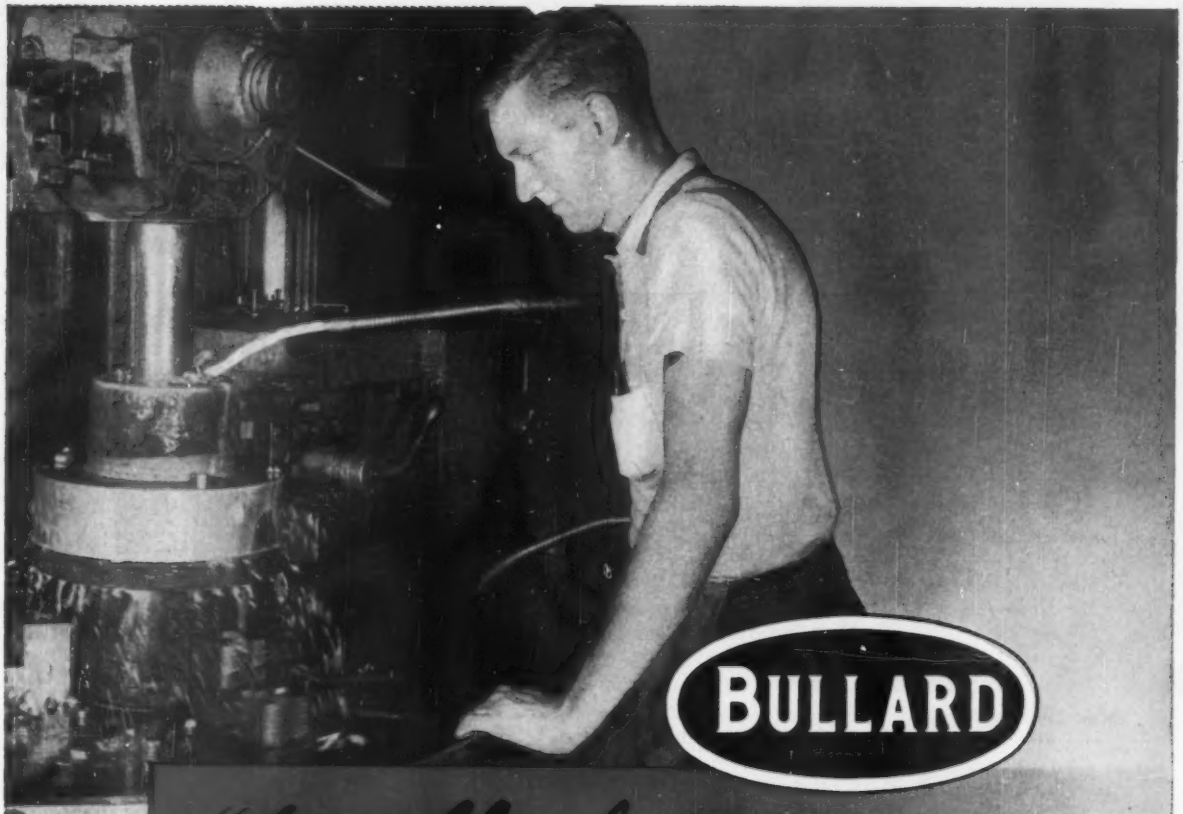
## R&D policy changes likely . . .

Latest round in the long-simmering Pentagon squabble over research & development policy is the sudden resignation of Assistant Defense Secretary Frank Newbury. Just named to head the Pentagon's recently-combined Research & Engineering Office, Newbury has long been the target of sharp criticism from scientists both inside and outside the military establishment.

**Newbury became a stormy petrel** at the Pentagon with his proposals to:

- Prevent military-sponsored basic research not directly related to specific weapon end-items.
- Standardize and restrict weapon development as a means of curbing duplicating projects and preventing new equipment from going into production too soon.
- Reorganize R & D administration at the Pentagon, with more authority in his own central coordinating shop and less for the military contracting agencies.

**There's gossip that Newbury's departure** was hastened by pressure on the administration by two of his leading antagonists, Quarles and Jimmy Doolittle, retired USAF General, who now heads the National Advisory Committee for Aeronautics and the Air Force's Scientific Advisory Board. Newbury's departure may mean a liberalization of military research policy.



BULLARD

"Less Maintenance—
Less Down Time
Increased our Production"

This statement by Methods Supervisor Raymond Hoss of the Ingersoll Milling Machine Company of Rockford, Illinois summarizes one of the benefits they received from the purchase of a 36" Cut Master V.T.L., Model 75. Less operator fatigue, higher speeds, power chucking and power indexing turret are other factors which increase the overall production obtained with Bullard Cut Master, Model 75.

*These same benefits can be applied to your production problems—just call your nearest Bullard Sales Engineer—he'll be glad to help—or write*

**THE BULLARD COMPANY**
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# Detroit ... NEWS REPORT

## Auto output is lagging...

Production of automobiles is currently some 11% behind the comparable period of last year. But a "spring market" appears to be forming in the low-priced field, where sales are running very well. Nevertheless, sales are not yet good enough to offset a reduction in second-quarter production scheduling—unless a big surge comes along fast. Bankers report that car loans are down compared with 1956, and that credit sales are averaging less than 60% of all cars sold.

**Chrysler is reversing its 1956 production run.** Off to a comparatively slow start with its 1957s, the corporation has been going full steam since, except for some walkouts in recent weeks.

**General Motors hit its 1-million car mark** for 1957 on April 19. Last year, GM chalked up No. 1,000,000 on April 5. Chevvy and Pontiac output is up slightly. Oldsmobile, after averaging 9700 cars a week, dropped to around 7500. Buick is off slightly, but Cadillac continues to maintaining an unwavering high schedule.

**Over at Ford,** production dropped off slightly around Good Friday; Mercury picked up a little at the same time; and Lincoln output slipped to the lowest total of the year. Continental production stopped dead for two weeks.

**American Motors** let Nash and Hudson production slip to 175 units (combined) a week, held the Rambler down to a 2150-unit level. Rambler sales were up in early April over comparable 1956. Overall, Rambler sales are increasing as Nash and Hudson continue to slip badly.

**In the truck field,** Chevvy is hitting the highest production level in the last 12 months; Dodge is holding steady at 1600 units weekly; Ford for the first two months its new models were on the market chalked up an all-time sales record. GMC production is down just a little.

## What's happening over at S-P?

As 103-year-old Studebaker-Packard heads into the last lap of its first year under management of Curtiss-Wright Corp, how does its future look?

**To S-P executives it looks bright.** They have trimmed and slashed at operating costs to the bone, and sales are up considerably.

**Last fall, at '57 introduction time,** it was generally agreed that S-P needed a break-even point of 150,000 unit sales.

**S-P was faced with the harsh fact** that it could not hope to get more than 1.5% of the market—and if that market proved out the about 6-million units, it looked like a 90,000 year for S-P, piled onto 1956's staggering losses.

**So S-P trimmed its sails** to what wind it could get, and by pruning has reduced its break-even point to 104,000 units. Before fall, S-P hopes to get this down to 80,000 units.

**Embarking on a course** that Detroit auto moguls say won't work, the South Bend people have announced a new "economy car." S-P will offer three Champion models. Although the announced price will be "below $1800," that means the two-door model only. The four-door will run $40 higher, the station wagon $200 more.

**S-P's economy cars** will be bereft of most of the fancy work that characterizes most autos. Only three colors will be offered, no two-tones or three-tones. One basic style trim will suffice for all three models. Heaters and turn signals will be the only things offered. Only option is overdrive—for extra money. Engines will be six-cylindered, with high fuel economy.

**Studebaker-Packard,** which will continue to make its regular lines, too, is seriously thinking about abandoning annual styling changes. The corporation is considering following the European trend of introducing a new feature only when necessary—keeping the car's basic styling and not outmoding it in a year or two (Volkswagen has been very successful with this idea).

**If this course is adopted,** and Detroit people will keep a sharp eye on its progress, it will mean an entirely new outlook for tooling.

**After the 20th of this month,** you'll see a full line of Mercedes cars in Studebaker-Packard showrooms. These cars will be styled and tooled in Europe, but assembled over here.

**As an internal manufacturing practice,** S-P will soon absorb manufacture of more and more parts.

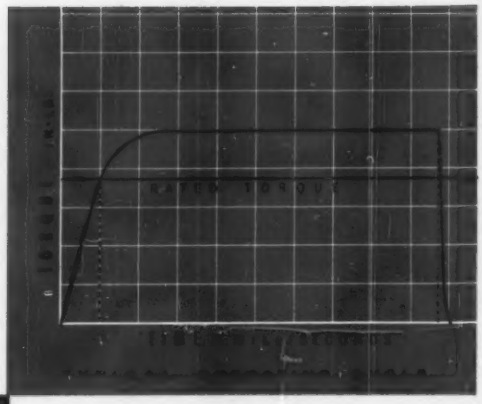
**But Stude-Packard still doesn't have as much** money as it would like to have, is dependent to a great degree upon Curtiss-Wright's exercising a management option to buy 5-million shares of S-P stock at $5 per share.

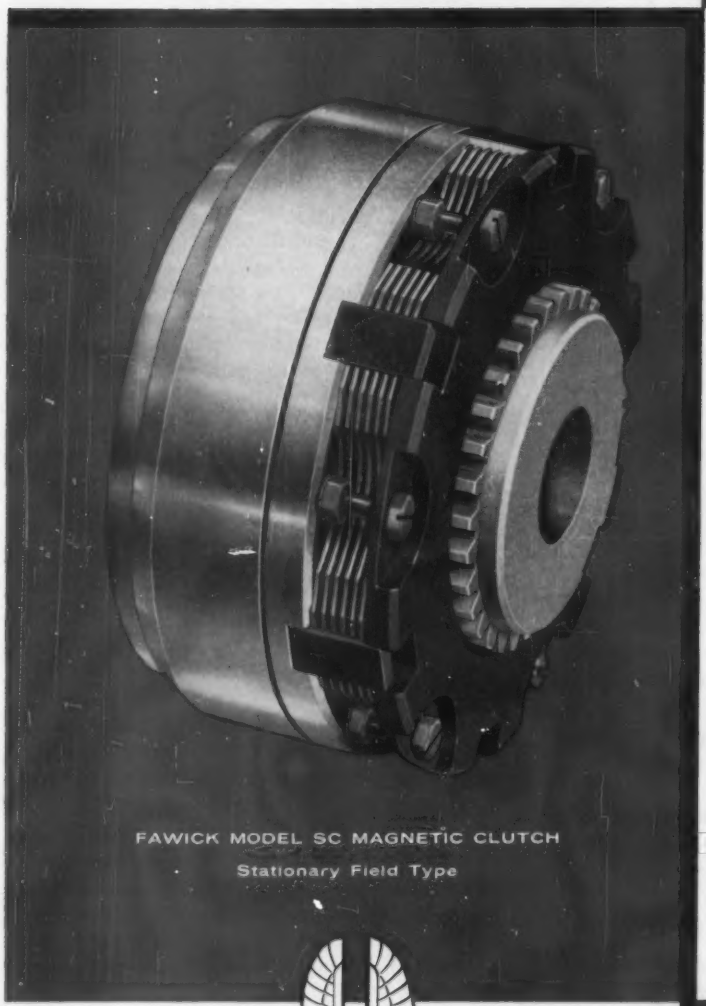
**There is no guarantee that C-W will do so.**

**Influencing the C-W board's decision** is the fact that so far the arrangement hasn't been very good for Curtiss-Wright, which had high hopes for the Utica-Bend operation, saw them go glimmering when the U-B-produced diesel engine failed to find sufficient buyers.

**Thus while S-P sales are picking up** (March was up 25% over February and the trend continues), C-W is taking a long look before it leaps.

# THE *FASTEST* ELECTRIC CLUTCH IS FAWICK MAGNETIC





FAWICK MODEL SC MAGNETIC CLUTCH
Stationary Field Type

■ Manufacturers and users of machine tools can speed up performance and shorten operating cycles with FAWICK Magnetic — the fastest-acting electric clutches and brakes available.

FAWICK'S patented design produces a faster "decay time" and eliminates "residual drag". Engagement is not only quicker but also smooth and shock-free. Response to controls is instantaneous with full power transmitted immediately.

Add this fast action of FAWICK Magnetics to their other outstanding advantages and you have "the world's finest electric clutch". And they are available at no extra cost.

FAWICK Magnetic Clutches and Brakes range in size from 2 to 13-inch diameters with torque ratings from 36 to 48,000 in-lbs. For further information, write the Home Office, Cleveland, Ohio for Bulletin M-101 or contact your nearest FAWICK representative.

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**FAWICK Magnetic**

INDUSTRIAL CLUTCHES AND BRAKES

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON RD. • CLEVELAND 11, O.
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# Machine tools ... NEWS REPORT

## Broaching study being made . . .

A study of the technological advances made recently in broaching, particularly in broaching tools, is being conducted by the Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce. The purpose is to make sure that these advances are being used to the best advantage for mobilization requirements. Aircraft Industries Association is cooperating with BDSA in this study.

**Determination of the facilities and capacity** of the industrial heating equipment industry is to be the objective of another study just getting under way by BDSA's Metalworking Equipment Division. A similar study of the welding equipment industry will be undertaken shortly.

**BDSA has recently completed** the most exhaustive survey ever made of the commercial tool and die industry. The survey covered more than 3000 shops and turned up information invaluable from the standpoint of future mobilization needs.

**Nowhere else in the U S government** is this sort of essential work being done. Realization of this fact has been responsible for strong pleas being addressed to key members of Congress in behalf of appropriation of sufficient funds to continue BDSA services unimpaired during fiscal 1958.

## Mission to India . . .

George Merryweather, chairman of the board of Motch & Merryweather Machinery Co, will head a machine tool mission to India scheduled to leave this country around June 1.

**Purpose of the mission** is to study the Indian market and the desirability of U S builders making agreements with Indian companies to have their machines manufactured in India.

**Other members of the mission:** Paul Hawkins of Monarch Machine Tool Co; Roy Jacobs of Jones & Lamson Machine Co; Joseph Vinbury of Abrasive Machine Tool Co; and Robert Fleming of BDSA's Metalworking Equipment Division.

## Good year assured . . .

Net new orders for machine tools totaled $60 million during March, which was just about the monthly average for the first quarter.

**The January-March figure of $181 million** is only a shade below the fourth-quarter performance of $187 million. It is a showing that is very good for a peacetime year.

**There is a feeling among builders,** based on an almost unprecedented volume of inquiries, that the dollar total of orders will move upward later in the year. Latest prediction is that net orders for the calendar year 1957 should be between $750 million and $825 million.

**Machine tool shipments in March** were just under $90 million, a sharp rise of $12 million from the February figure. The industry shipped $244 million of machine tools to customers in the first quarter.

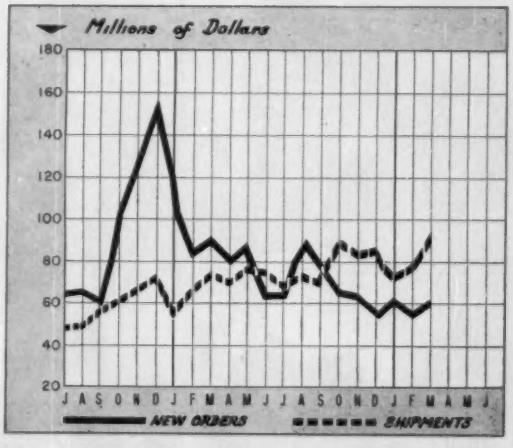
**The year's estimated shipments** now are put within a range of $850 million and $925 million. In other words, 1957 already can be chalked up as a prosperous year for the industry.

## Transfer machines being rebuilt . . .

Detroit has asked at least two important machine tool builders to take on the rebuilding and retooling of their own transfer-type machines in preparation for new-model production.

**Auto makers, in addition, have farmed out** some rebuilding work to contract machine shops.

**In placing orders** for new huge transfer-type equipment with the machine tool people, automobile companies now are allowing more time than ever before—up to 18 months—for the extensive engineering work involved and the manufacture and assembly of the units.



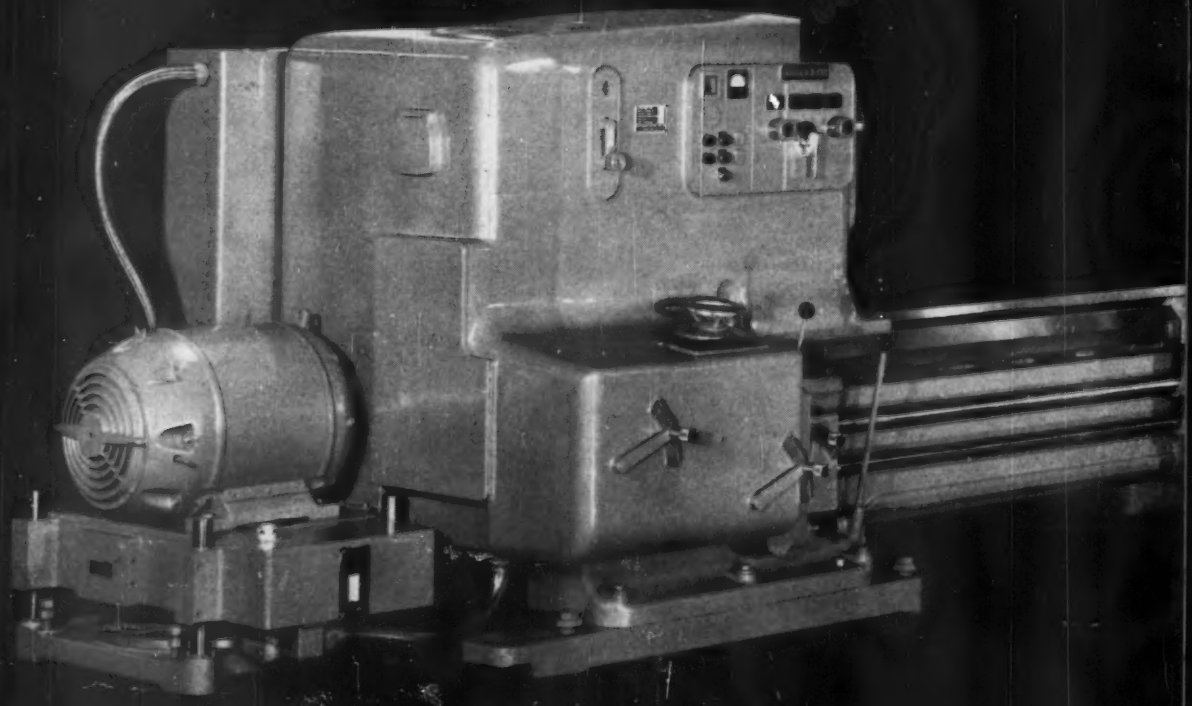

**FOR THE MONTH OF MARCH,** shipments of machine tools jumped sharply from February's $77.7 million to nearly $90 million. Net new orders rose from February's $58.2 million to $60 million in March on the National Machine Tool Builders' Association Index

# BRAWN

BRAINS

**The MONARCH SERIES 90 DYNA-SHIFT HEAVY-DUTY LATHE – Model 2500:** Clearance diameter —40″ . . . Swing over cross slide 25″. **Model 2501:** Clearance diameter—44″ . . . Swing over cross slide 31″. **Model 2502:** Clearance diameter—48″ . . . Swing over cross slide 36″.

When progressing from diameter to diameter, speed is changed in a few seconds with the flick of *one* dial. The *machine* calculates each speed and changes speed automatically. And the wide available range assures selection of the *right* speed for the diameter to be turned.



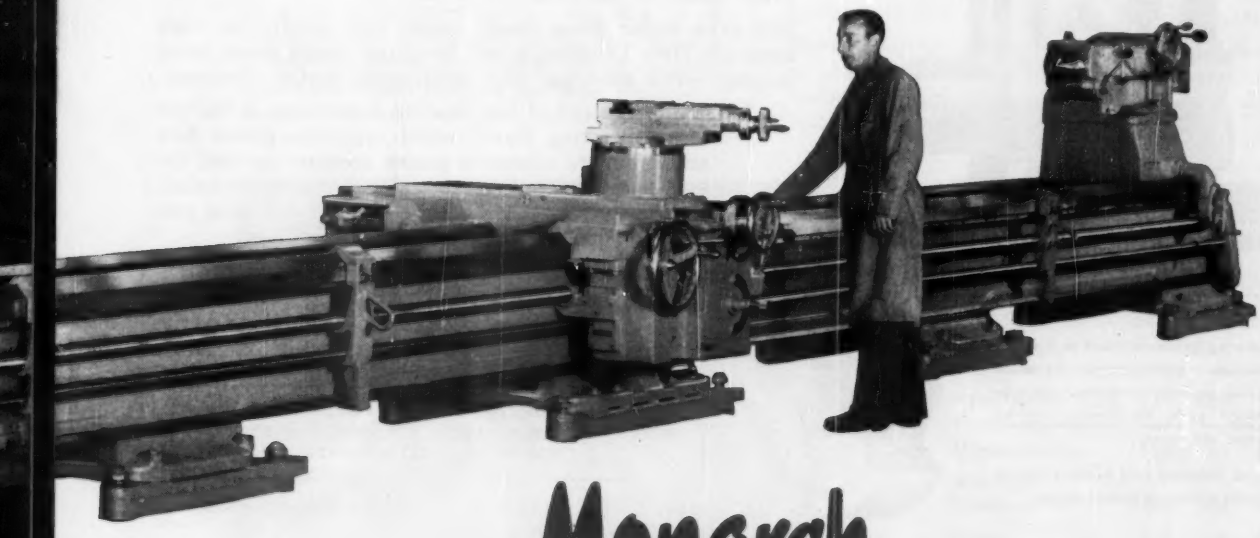
# . . The Monarch Heavy-Duty Dyna-Shift

In a class by itself! Just set the work diameter indicator. In a flash, the exclusive Dyna-Shift drive headstock calculates and delivers the ideal spindle speed (36, from 6 to 750 RPM).

You get strength and power to match the brains. The equivalent of 60 H.P. gives this lathe the power to break and the speed to burn any carbide tool. And the massive design supports the heaviest of cuts.

Now, you can use carbide tooling to its ultimate advantage, with metal removal rates up to 120 cubic inches per minute, turning alloy steel. Always used at proper cutting speed, you get the ultimate in productiveness, maximum tool life, and close accuracy.

*Here's a machine you've got to know about, and our twenty-four page illustrated booklet #1601 tells you in detail. Just ask . . . The Monarch Machine Tool Company, Sidney, Ohio.*



**Monarch**

**TURNING MACHINES**

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

# FACTS

about

## NEW DEPARTURE BALL BEARINGS

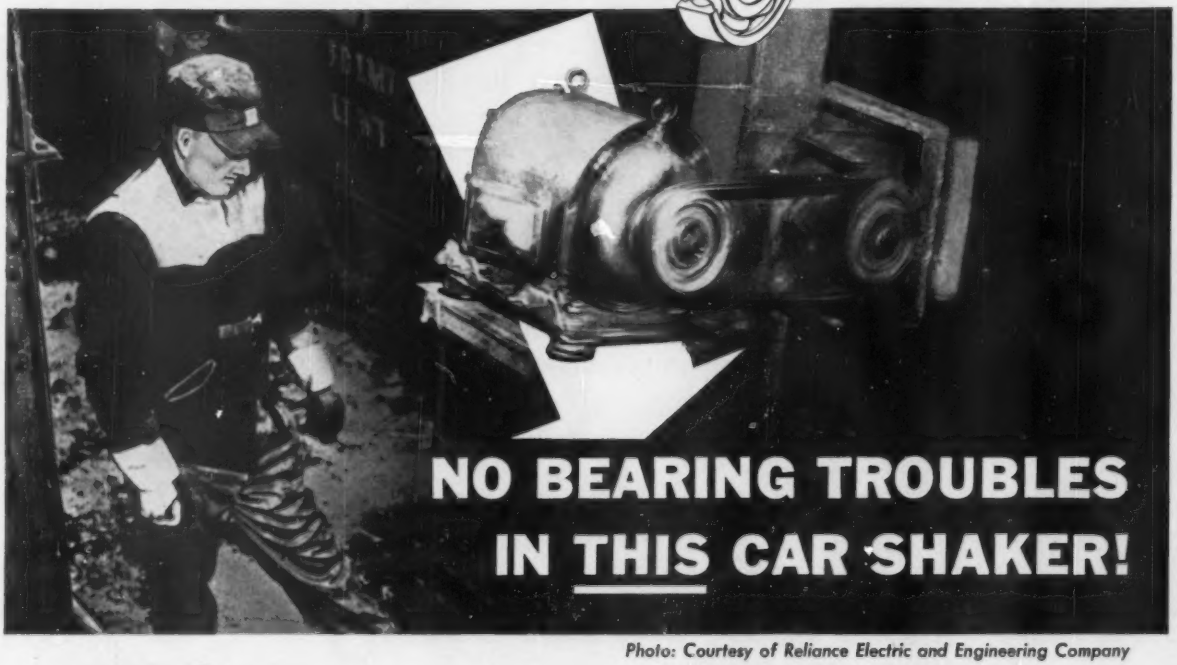
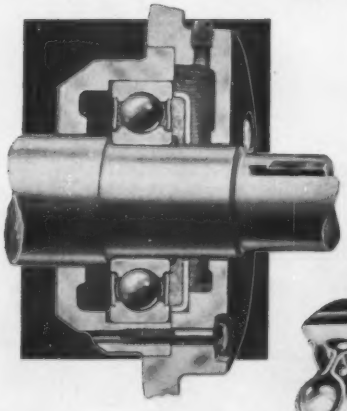



*Photo: Courtesy of Reliance Electric and Engineering Company*



Metering plate adjacent to bearing prevents overlubrication. Excessive grease pressure is relieved *outwards* around shaft. No grease can be forced into motor.

Right: Shielded ball bearing always retains adequate grease supply.

Driving a car shaker is like riding a bucking bronco—and the motor and bearings that do the job have *got to be* tops in every detail for such rugged service.

But even under these rough, tough load conditions, high capacity New Departure ball bearings assure exact rotor location—full electrical and mechanical motor efficiency.

An important feature of the bearing mountings is the use of a "metering plate" which regulates grease flow and prevents excessive grease pressure against the bearings. They cannot be under- or over-lubricated. Yes, motor and bearings are built to maintain precision at operating extremes.

Such motors are safe for long periods without attention—the bearings are fully protected from dirt and there is no grease leakage into the windings. Write for details on New Departure shielded ball bearings.

**VISIT NEW DEPARTURE AT THE DESIGN ENGINEERING SHOW, COLISEUM, NEW YORK CITY, MAY 20-23, 1957, SPACE 1240**

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

**BALL BEARINGS MAKE GOOD PRODUCTS BETTER**

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

# What's ahead ... in Metalworking

NEWS REPORT

## Production going strong . . .

Metalworking production is going strong as the spring season progresses. No significant drop, if any, is in sight this quarter, with operations continuing at any all-time peacetime peak.

**All areas of Metalworking** are showing production strength. Capital goods still supply a high share of the total volume, however.

**Aircraft manufacture** and the building of heavy electrical apparatus are especially active.

**Farm machinery and tractor businesses** have picked up substantially in recent weeks.

**Freight car production is reported very good** by important builders. Diesel-electric locomotive orders are so big that current top operations are assured the next year or two or even longer.

**Automotive situation appears less drab,** with parts makers pleased with the trend. One prominent company reports a good April after a soft first quarter and further improvement forecast for this month. Feeling is growing that the final quarter's auto production will be higher than last year's because there will be less downtime this year for changeover to new models. Auto replacement parts business has increased, too.

## Fourth quarter looks good . . .

Many steel people are betting that the industry as a whole will average 85% in the second quarter, 80% in the third quarter and 90% in the fourth. Supply of narrow light plate is growing as tonnage of this item comes off of sheet and strip mills whose capacity has been released by lessened demand for sheet products. Heavier, wider plates and structurals, however, will continue in short supply indefinitely.

**Reduced orders from auto and appliance industries** have forced sheet and strip mills to cut their schedules substantially. Construction of oil and gas pipelines has brought a heavy demand for line pipe that will keep pipe mills busy.

**Commercial stamping plants** are recording small gains and estimate that their 1957 volume will surpass last year by up to 10%.

## Airframe people very busy . . .

Production outlook is good among major West Coast airframe makers, with backlogs up from year ago.

**Lockheed's California Division,** with current pileup of orders above $1 billion, is a prime example. It does not expect its backlog to drop below the billion mark all year.

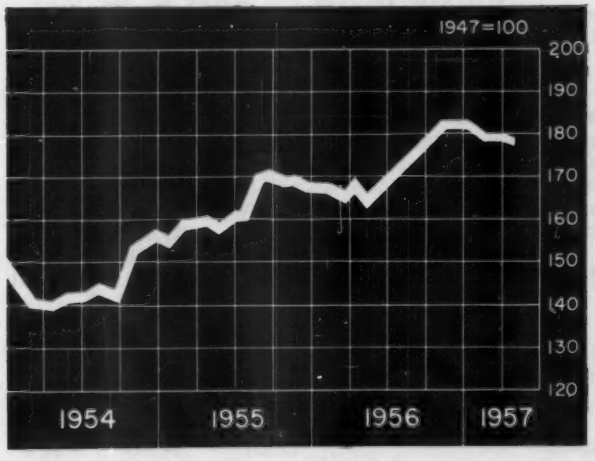
**Aircraft employment is slightly higher** than in 1956 and should stay about where it is.

**Few manufacturers report** any large new military plane contracts that might have an immediate effect upon production or employment.

**Missile deliveries this year** will represent a higher ratio of aircraft work than last year. Observers predict a slow but steady decline in military airframe making the next 2-3 years.

**Companies operating exclusively** as aircraft subcontractors report trouble in booking orders.

**Reasons are the switch to missiles** and tendency of airframe producers to handle in separate divisions of their own firms much of the work formerly farmed out.




178

**AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION**

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

| | APR. Estimated | MAR. Preliminary | FEB. Revised | MAR. Year Ago |
|---|---|---|---|---|
| **Total Index** | **178** | **179** | **180** | **166** |
| **Machinery** | **154** | **154** | | **146** |
| **Electrical Machinery** | **206** | **205** | | **191** |
| **Autos** | **132** | **140** | | **134** |
| **Other Transportation** | **382** | **366** | | **310** |
| **Other Metalworking** | **144** | **144** | | **137** |

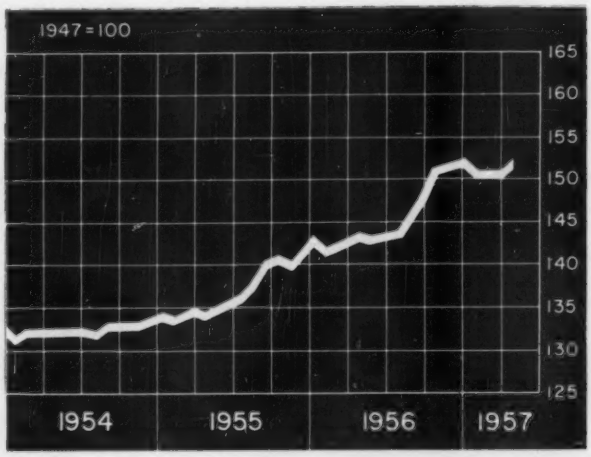
NEWS REPORT

# What's ahead . . . in Business

**AMERICAN MACHINIST INDEX OF METALWORKING PRICES**

| | APRIL Estimated | MAR. Preliminary | FEB. Revised | MAR. Year Ago |
|---|---|---|---|---|
| **Total Index** | **152.0** | **151.7** | **151.5** | **143.5** |
| **Metalworking Machinery** | 175.0 | 174.9 | 164.3 | |
| **Other Machinery exc. Electrical** | 160.2 | 160.0 | 149.5 | |
| **Electrical Machinery** | 153.3 | 153.1 | 141.2 | |
| **Fabricated Metal Products** | 143.5 | 143.3 | 137.8 | |

152




## Profits, prices and tight money . . .

It is becoming increasingly apparent in reports from many companies in many segments of industry that 1957 sales are increasing, but profit margins are dropping off.

**That means that the costs of labor,** materials and operations generally are climbing faster than end-product prices. One reason why prices can't keep pace with costs today is the intense competition which makes every manufacturer reluctant to be the first in his field to up prices.

**Something has to give somewhere**—and cost-cutting on basic operations seems to be the answer. To some firms caught in the profits squeeze, layoffs look like the solution. But to others, automation, new equipment and new processes are the means of keeping a business profitable. The latter solution is, of course, the logical one—layoffs help no one.

**But new plants, new equipment and research** for new products and processes cost money—and money is a hard thing to find these days.

**Most of the current squeeze on credit stems** from the Federal Reserve Board's decision to increase the interest on its loans to member banks. With the discount rate raised from 1.5% in 1955 to 3% today, banks are watching over their available lending money like guardian angels.

**Now, the situation has reached a point** where the administration itself is divided. The Federal Reserve Board wants to keep money tight as a hedge against inflation. Other administration people, Secretary Humphrey for one, say such a policy could throw 5-million people out of work, trigger off an economic downturn.

**But both factions are agreed on one thing**—money can't possibly get any tighter than it is now, and by one means or another you can look for credit to loosen within the next few months.

### WEEKLY BUSINESS INDICATORS

| | Latest Week | Preceding Week | Year Ago |
|---|---|---|---|
| *Business Week* Index of Activity (1947-1949=100)* | 144.9 | 144.7 | 146.8 |
| Steel ingot operation (thousands of tons) | 2,310 | 2,313 | 2,473 |
| Electric power output (million Kilowatt hours) | 11,485 | 11,695 | 10,894 |
| Production of automobiles and trucks | 151,866 | 160,370 | 167,530 |
| Engineering construction awards (Eng. News-Record—millions) | $439.6 | $394.5 | $526.0 |

### MONTHLY BUSINESS INDICATORS

| | Latest Month | Preceding Month | Year Ago |
|---|---|---|---|
| Index of industrial production (1947-1949=100)* | 146 | 146 | 141 |
| Index of durable manufacturers' production (1947-1949=100)* | 163 | 164 | 157 |
| Durable goods manufacturers' sales, millions* | $14,722 | $14,642 | $13,593 |
| Machinery manufacturers' sales, millions* | 4,230 | 4,205 | 3,647 |
| Durable goods manufacturers' new orders, millions | 13,831 | 14,393 | 14,107 |
| Machinery manufacturers' new orders, millions | 4,017 | 4,209 | 3,953 |

* Seasonally adjusted.

# -40%

## "Job costs reduced up to 40%

*with our two BURGMASTER® turret drills"*

*So states The H. K. Porter Company, Somerville, Mass.*

As the illustration shows, they use one operator to handle two Model 2BH Burgmaster 6-spindle automatic hydraulic turret drills. The part (cross sectional views of 2 sides shown) is an 1117 steel forging and the work on this job consists of a total of 22 operations involving drilling, tapping, reaming, counterboring and countersinking. The operator reports close concentricity held on all operations with good finish and depth control and with plenty of time to inspect work while machines are running. Setup time is reduced and greatly simplified.

**AUTOMATIC HYDRAULIC BURGMASTERS (6- and 8-spindle models) feature skip indexing, automatic cycling and infinitely variable preselective feeds. All models (automatics, manuals, radials) provide power indexing, preselective spindle speeds and very close preselective depth control. Capacities from 3/8" to 1½" available.**

*For complete details, write AM-5*

**BURG TOOL**
*Manufacturing Company, Inc.*
15001 South Figueroa Street, Gardena, California

RIDGEWOOD, N. J. • CHICAGO • CLEVELAND • DETROIT • SAN LEANDRO, CALIFORNIA

Series No. 4B12 Steelweld Shear. With more than a half century of experience in steel warehousing, Enos & Sanderson know what good shearing is. They are proud of this machine. They advertise that: "Trained shearing teams will give you the finest edge ever cut with this Steelweld".

# "NEVER SEEN A *SMOOTHER* OPERATING SHEAR"

## *Steel Warehouse Elated with Steelweld Shear*

For 57 years The Enos & Sanderson Company, Buffalo, N. Y. has been supplying steel sheets and plates to hundreds of Niagara Frontier factories. Recently they installed a Steelweld Shear in their new warehouse. This is used for cutting various thicknesses to 1/4" x 12', as per customer orders. Cuts must be smooth, straight and accurate. Speed is essential to provide best service possible.

Enos & Sanderson's new 35,000 sq. ft. steel warehouse

The following paragraph in an unsolicited letter from Enos & Sanderson indicates how well their Steelweld Shear is serving their needs:

*"We are extremely satisfied with the operation of this unit and would recommend this machine highly to anyone. A rigger, who set up this shear for operation, remarked that, in his twenty-five years of work with shears of all types, he had never seen a smoother operating shear in his experience."*

*GET THIS BOOK!*

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

**THE CLEVELAND CRANE & ENGINEERING CO.**

*1435 EAST 282nd STREET, WICKLIFFE, OHIO*

**STEELWELD PIVOTED BLADE SHEARS**

American Machinist

MAGAZINE OF METALWORKING PRODUCTION · ESTABLISHED 1877

# It's a Hair Curler, For Sure

You no doubt have read a lot of theorizing about the glorious future of our economy. Much of it has consisted of the projection of figures based on actual performance in years past. You may have been inclined, as a result, to dismiss or discount it as dream stuff.

It is heartening then to be able to come up with authentic and convincing facts to support the thesis that the best days of industrial America—and that goes for Metalworking too—lie ahead.

These facts have been uncovered by the tenth annual survey by McGraw-Hill's Department of Economics of U S industry's plans for capital spending in the four years 1957 through 1960. They make exciting reading (for detail story, see p. 162).

## 1957 will establish...

a new high in dollar outlay for new plants and equipment. For 1958-1960, business already has plans for almost as much capital spending as during 1956. Mind you, actual expenditures usually outstrip preliminary estimates.

Perhaps most significant of all, manufacturers are stepping up sensationally their outpouring of funds for research and development. The metalworking industries spent $2.8 billion in 1955, are increasing the sum to $4.7 billion this year, and three years from now will be paying out $6 billion annually.

Research and development have as their goal the bringing into being of new products. By 1960 close to one-fifth of all sales of machinery and electrical machinery will be in new products not now being made or sufficiently changed to be reasonably considered as new products. In aircraft, ships and railroad equipment, more than one-third of all sales will be in new products. Even in 1957, a high percentage of capital expenditures will be allotted to making new products.

## Within the next three years...

manufacturing companies estimate that their physical volume of business will rise 19%. In Metalworking expectations are higher than that, going up to 25% in the machinery industry.

Just to show what is happening, Metalworking's capacity for producing goods was at 166 in 1956, with 1950 taken as 100. At the end of this year, the figure will be 178. It will have gone up to 210 by 1960, having more than doubled in a decade.

No matter how you look at it, the survey figures point to a vigorous growth of American industry, and particularly of Metalworking, during the remainder of the 1950's. Billions upon billions of dollars will be "laid on the line" for new facilities and for modernization of old plants and equipment, for finding and developing new products and for tooling up for their manufacture.

## More skilled manpower...

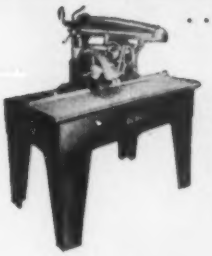
will be needed too. Manufacturing companies say that they will require 15% more engineers and scientists by 1960 than now, and that this year they must have 7% more than in 1956.

What greater testimony can there be to confidence in the future growth and prosperity of our economy than the plans that industry and business have for the four-year period 1957-1960.

If any future economic events are to curl our hair, as the Secretary of the Treasury suggested, the curling is more likely to be the outcome of prosperity than depression.

Burnham Finney EDITOR

# 1/3 cost reduction combined with product improvement...by use of Cincinnati Shear and Press Brake



## ..at DE WALT INC.

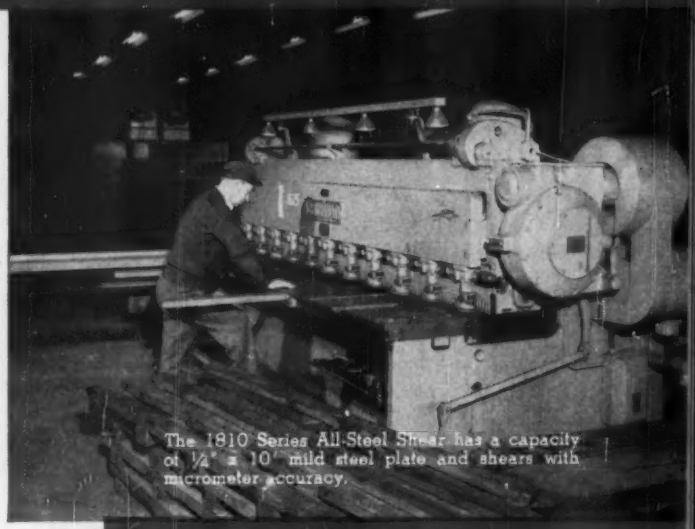
Lancaster, Penn.

The steel bases of all DeWalt woodworking machinery must be perfectly square, flat and true. Both home shop and heavy duty industrial machines are produced on the Cincinnati Shear and Press Brake shown.

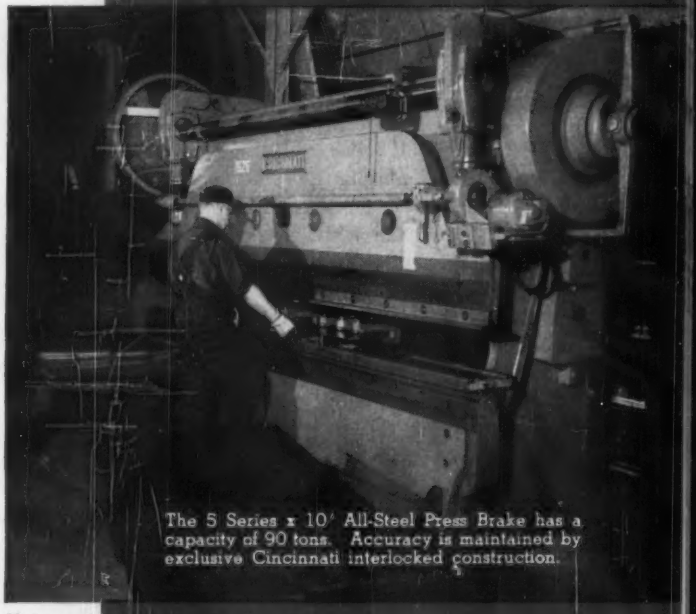
This performance story from DeWalt Inc. tells of improved quality and reduced costs. We quote: "Before purchasing the Cincinnati Shear and Press Brake, we bought formed channels and arc welded them together at the seams. We now buy sheet steel stock—then cut, punch, form, and spot weld the steel bases in our own plant. We have ***reduced costs on this operation by over 1/3*** on the first run employing these methods, and expect costs to diminish still more as operator familiarity and efficiency increase. In addition to the cost factor, it was previously difficult to maintain precise flatness in the tables. Using the new methods and the Cincinnati machines, we now have no difficulty."

Note the improved design of the Model MB "Power Shop" machine shown at right above. The new, improved cabinet is now produced on the Cincinnati Shear and Press Brake at an ***overall cost reduction of 15%***. Previously the cabinet at left was a purchased item.

Write Department A for Catalog B-4R and Catalog S-7R and consult our Application Engineering Department about your production problems.



The 1810 Series All-Steel Shear has a capacity of ¼" x 10' mild steel plate and shears with micrometer accuracy.



The 5 Series x 10' All-Steel Press Brake has a capacity of 90 tons. Accuracy is maintained by exclusive Cincinnati interlocked construction.

Photos courte[sy] DeWalt Inc., Lancaster, Pa.

**THE CINCINNATI SHAPER CO.**

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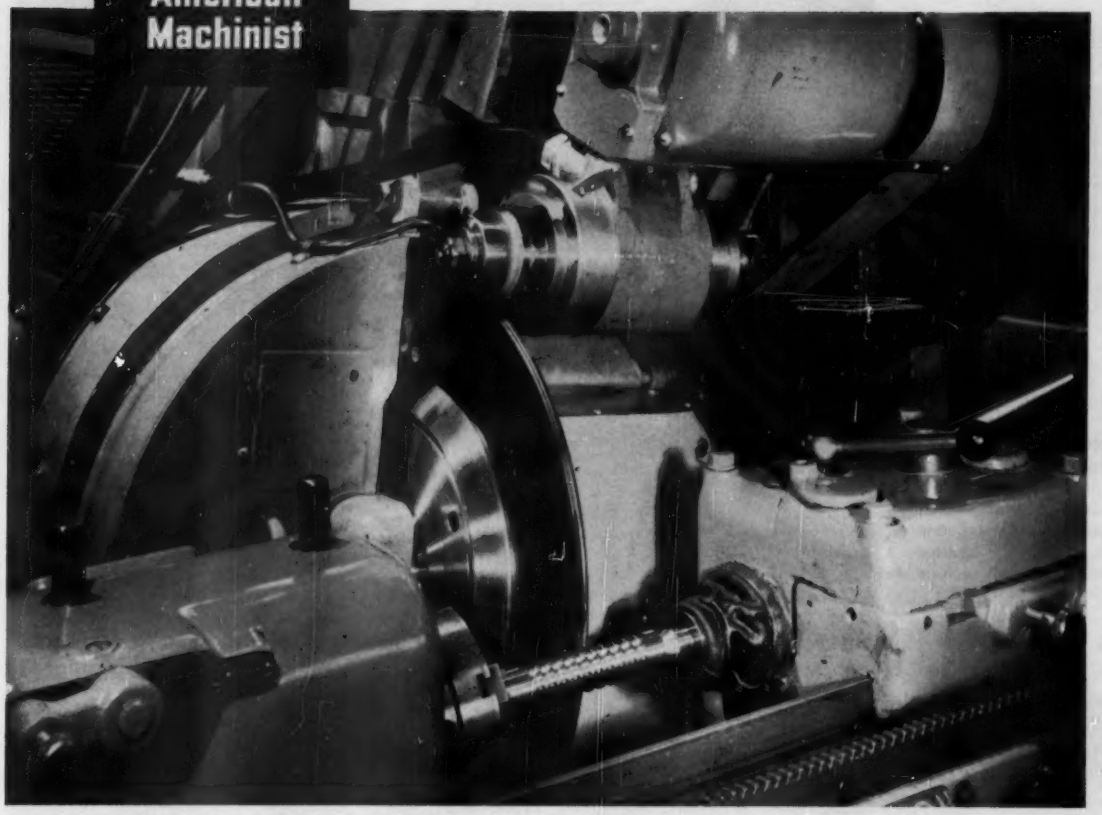
American Machinist



**Diamond-impregnated roll** dresses wheel (in this experimental setup) to grind a steering-wheel worm. It marks the birth of . . .

# Continuous-dress grinding

ANDERSON ASHBURN, managing editor

Complete automation of production grinders now seems practical with a development that permits continuous dressing of the wheel form while the grinder is in operation.

Perhaps of even greater importance is the fact that the cutting method used to dress the wheels results in a freer cutting wheel that may change grinding practice.

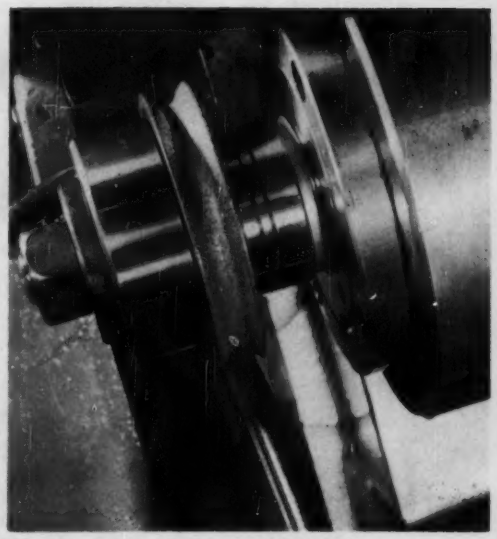
This new process is the inspiration of Ernest V Flanders of Jones & Lamson Machine Co and was developed jointly over a five-year period by J & L and Koebel Diamond Tool Co.

Key to the process is a form cutter for grinding wheels containing cemented diamond particles (CDP) in a powder-metal body. The cutter is used in a setup to provide continuous or cycle dressing to provide "perpetual form control" (PFC).

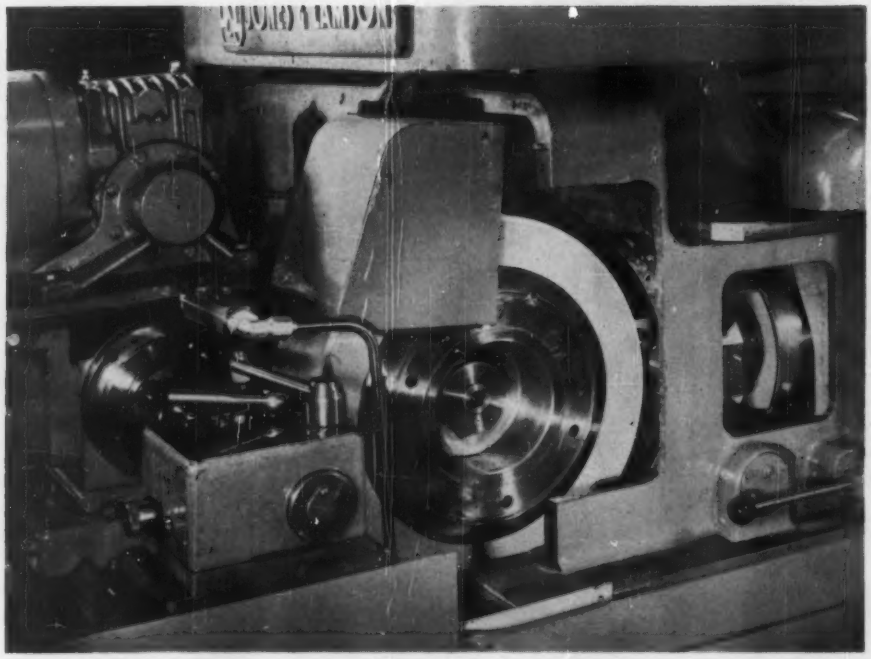
A parallel approach to cycle dressing has been taken by Ex-Cell-O Corp using diamond-impregnated segments made by Koebel and by Wheel Trueing Tool Co.

The diamond cutters currently use diamond particles of about 140 mesh distributed to a depth of 1/16 in. in the cutter body. A wheel with a 25% diamond concentration has not been satisfactory but this may be the result of uneven distribution. At present, higher diamond concentrations are used but the optimum is not known.

In either application, wheel dressing is performed with a diamond cutter and the accu-



**Diamond particles imbedded** in the powder-metal body of the dresser are visible in this view of the experimental setup. Diamonds are 140 mesh to 1/16-in. depth



**Cycle-control application** of the new dressing device provides for a dressing cycle while part is loaded. This installation is on a Jones & Lamson Model E automatic form grinder

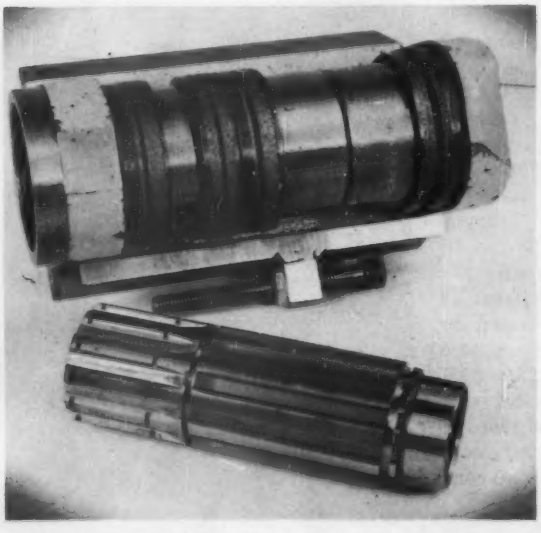
racy that can be obtained is limited by the ability to hold the diamond cutter to size in the sintering process. At present, the tolerances are ± 0.001 in. on diameter and ± 10 min of angle.

Limits of this degree are satisfactory for automotive transmission shafts and many other applications but are not close enough, for example, for the root form on turbine buckets or blades.

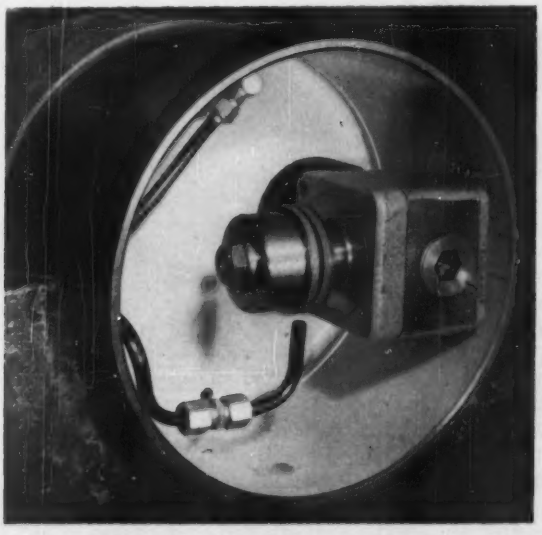
When methods have been developed for holding closer tolerances on the cemented-diamond cutters, the field of application will be considerably broadened. The most promising avenue is to develop accurate methods of sizing the cutters after their final sintering. Presumably this could be done by ultrasonic cutting of the matrix metal.

J & L is building several cycle-dress machines for a Buick transmission shaft (shown at lower left). On this setup, the wheel is slowed to 120 sfpm during the dressing cycle and the cutter rotates in the same direction (meaning that at the contact point the wheels are moving in opposite directions). Cutter speed is 80 sfpm, giving a relative speed between wheel and cutter of 200 sfpm. The cutter is powered by its own ¾-hp drive motor through a chain and sprocket.

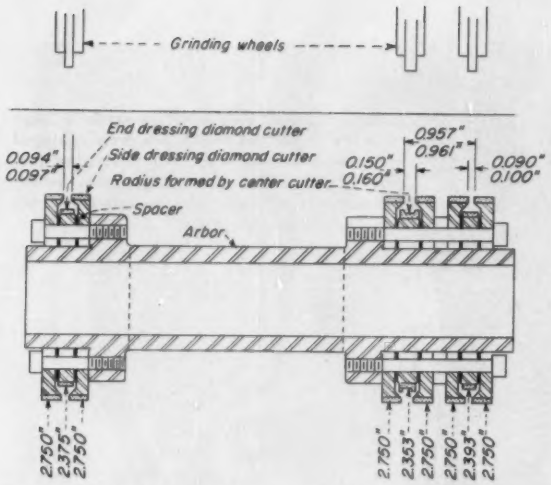
With this setup the dresser gen-



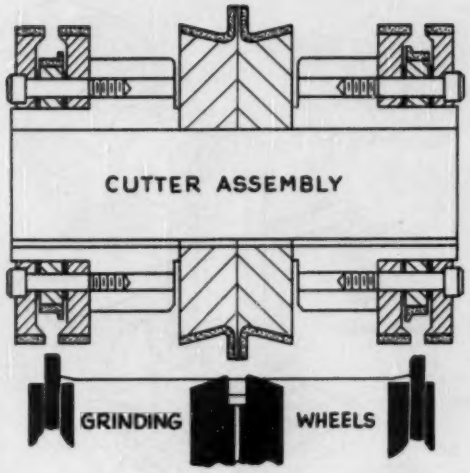
**Splined transmission shaft** will have four grooves ground. This is one of the first commercial applications of the cycle grinder. The dresser is shown here with a ground shaft. This is for the setup in the Model E pictured above



**A single wheel-dressing cutter** mounted in the feed cylinder (with cylinder removed from the machine). Pressure jet cooling is applied to the diamond cutter as the feed cylinder advances it to the grinding wheel




**Typical cutter design** for cycle dressing three wheels. J & L has applied for patents on this cutter design. Spacers between the three diamond cutters for each of the grinding wheels provide for adjustment of grinding wheel width. Cutting a total of 15 resinoid wheels down from 20-in. dia to 16-in. dia produced a wear on one set of these cutters of 0.0003 in. on a side. When wear exceeds tolerances, spacers must be changed




**Eight diamond wheels** are combined in this setup to produce two grooves and a flange on a transmission shaft. The first of these J & L cycle-control machines has just been shipped to a European automotive producer

erally removes 0.001 to 0.0015 in. on the radius of the grinding wheel. As many as 40 pieces per dress can be ground in hardened SAE 1041 steel, but 15 to 30 pieces is a good average.

Either resinoid or vitrified wheels can be used, but resinoid are preferred except when unbalanced grinding forces are present (as in grinding a shoulder).

Present production applications will use the conventional grinding speed and the same grinding oil as formerly used for the operation.

Method of coolant application is critical, however. The coolant is applied at 25 psi through jets to the grinding wheels above the point of contact with the work and also to the bottom of the work. Enough cutting oil should be applied to quench all sparks.

At Ex-Cell-O, which is building 14 machines for the same Buick transmission shaft, the diamond cutter is made up of segments representing 60 to 90° of the full 360° roll used by J & L. Size of this segment depends on the number of parts to be produced (and thus on the amount of dressing the diamond segments will be required to provide).

To dress a wheel for a groove, three of these segments are mounted on a shaft with spacers. A cross section through this combination looks exactly like the J & L cutter illustrated.

The Ex-Cell-O setup is also an automatic cycle dress determined by number of parts ground and with wheel compensation. However, the dressing is accomplished by rotating the shaft on which the diamond segments are mounted one full turn with the grinding wheel operating at grinding speed.

The cycle grinding application is really an intermediate step to the application of continuous dressing. At present one continuous-dress machine is operating on an experimental basis in the J & L plant. Improved machines that incorporate continuous-dress grinding are now in the design stage.

Cost of the unit varies primarily with the number and type of diamond cutters required. A Model E form grinder equipped with cycle dressing and twelve diamond cutters, for example, would cost about $5500 more than the same machine without these features.

Future possibilities require only a little dreaming. Very little is actually known about the process today. It has been found that higher grinding speeds—perhaps at 10,000 or 15,000 sfpm—are possible. This may put new requirements on the manufacturers of grinding wheels.

We don't know the possible effects of changing concentration and mesh size of the diamonds, of changing relative speeds of grinding wheel and diamond cutter, and the possible results with titanium and other materials that are now ground at below-normal speeds. All this will require a lot more research. We do know that the synthetic diamonds and other hard materials, such as Borazon, that will eventually be available in quantity will be ideal for these cutters. The shape of synthetic diamonds (chunky) would be superior to the crushing bort (which includes slivers) now used.

We can conjecture that the major use of the method may not be in form grinders at all. It may lie in the high-volume cylindrical grinders.

It is also notable that the idea, like all basic advances in Metalworking, is essentially a simple one. Powder-metal techniques are well developed. It is a safe bet that there will soon be other variations on this basic method.

Both Koebel and J & L know this. At the moment they have a lead in development and they are banking on this as industry looks at the possibilities of bringing real automation to grinding with continuous dressing of the wheels.

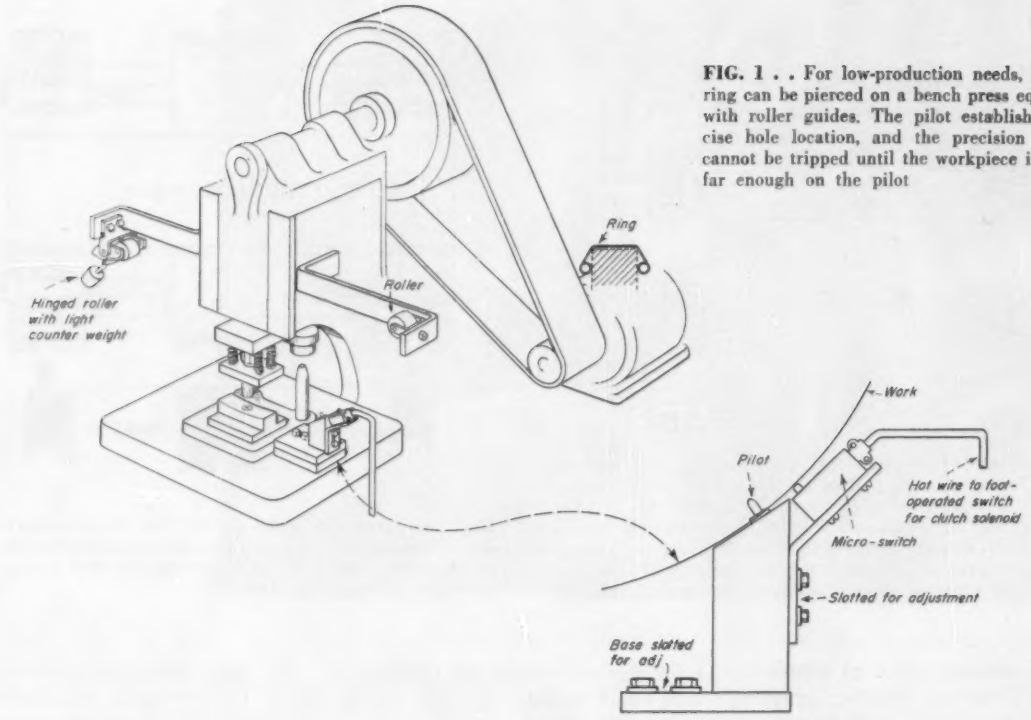



**FIG. 1 . .** For low-production needs, a large ring can be pierced on a bench press equipped with roller guides. The pilot establishes precise hole location, and the precision switch cannot be tripped until the workpiece is down far enough on the pilot

# Five ways to pierce rings

**Here are methods and machines that can be adapted to perform a wide variety of perforating, piercing, notching, and light forming operations in rings, tubular parts, and the side walls of large shells**

BUCKLEY SULLIVAN

The piercing of holes in large rings always presents problems to the tool designer. Some of these problems are (1) how to locate the piece, (2) how to hold it, (3) how to index it, and (4) should the holes all be made at once?

The machines described illustrate three simple rules that have been proved in practice:

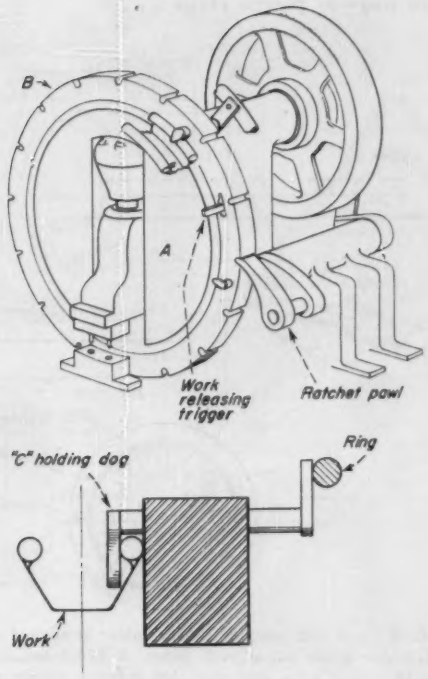
1. If production is low, build tooling around a standard press of proper capacity, producing one hole or a convenient group of holes at a time. The indexing method is determined by production requirements, and may be manual, by means of a simple ratchet and pawl mechanical, or perhaps an air-cylinder arrangement. Design of locating devices for indexed workpieces is determined by the accuracy required. Special machines are indicated where production requirements are high. Such machines may also set the size of the work by shrinking.

2. For easy loading and handling, if a workpiece is less than 18 in. in dia, hold it vertically; if over 18 in., lay it horizontally.

3. Always pierce from the inside out. Experience has taught that any burr which may result from piercing can be removed more readily from an external surface.

The simplest form of ring-piercing equipment is a bench press, because the punch and die are readily changed for varying diameters and cross-sections of work. Put a locating post to the right of the die. The workpiece is loaded upright and is located in the vertical plane by brackets on each side of the press. The first hole is pierced at random. Then, while supporting the work with his left hand, the operator rotates the ring counter-clockwise with his right hand until the previously pierced hole drops over the locating post. This procedure locates the work for piercing the second hole and the process is repeated for the others. The 18 holes are pierced in rings from 9 to 16 in. in dia at an average rate of 250 to 300 pc per hr.

Obviously, a setup of this kind does not produce high precision. By slight modifications, a similar press, Fig 1, can be made to pierce holes within a




**FIGS. 2 AND 3 . .** Small rings are pierced on the fly in this setup. The ratchet pawl is operated by a crank connected to the flywheel to advance the work-holding ring as the ram goes up. After all holes in the ring are pierced, a cam disengages the clutch

center-to-center tolerance of ± 0.005 in. This part is 20 in. dia and has 32 holes. It is handled vertically, contrary to Rule 2 above, because of its light weight and low-production requirements. Precision is obtained by using a standard guide-pin die set, a light stripper plate, and a locating device. The part is indexed manually as in the first example.

Precision in center-distance location is a function of the fit of the pilot to the previously pierced hole. The punch and die must be kept sharp to control hole size, and the pilot must not be allowed to wear undersize. The designed clearance between the pilot and the hole should be kept in mind when determining the tolerance within which the setup will operate. To eliminate the possibility of the part not being properly located on the pilot, a precision switch is arranged so the foot switch for the solenoid-operated clutch is not activated until the work is down far enough on the pilot to close the Micro-Switch.

A small ring is produced automatically in fairly high quantities and not to close tolerances on the bench press shown in Figs 2 and 3. One operator produces about 450 pcs per hr on two machines. About the head of the press is a frame-work *A*, with rollers which support and locate a ring *B*. This ring locates the work and clamps it by means of small dogs *C*, which are engaged or disengaged by a hand lever on the face of the ring. In this design, the press clutch is always engaged, a small clutch on the drive motor replacing it. As the driving clutch is engaged, the flywheel and crankshaft revolve. A pitman on the flywheel operates a simple pawl, engaging slots in the periphery of the ring *B*. During each stroke of the ram, the pawl advances the work-holding ring. When 18 pairs of holes are pierced, and the ring has made full circle, a simple cam on the back of the work-holding ring disengages the clutch to prevent double-piercing.

A different ring, 3/16 in. thick by 26 in. dia, is pierced while in a horizontal position on an entirely different arrangement, Fig 4, mounted in a heavier OBI press. Quantities on this part warranted automatic indexing. There are 12 sets of holes, each consisting of a ½-in. and a ¼-in. hole placed 1 in. apart. Tolerance on center-to-center distance of hole groups is specified as ± 0.010. The ring is placed on 12 hardened pads mounted on a rotatable dial plate, and located by buttons on the pads. Four small air cylinders mounted on the edge of the dial plate clamp the ring in place by means of bellcrank arms. Air lines to the cylinders lead to the center of the dial plate, pass through a rotating air fitting and lead to a foot valve. There are 12 sliding punch holders mounted in gibs on the dial plate, one at each station, and one sliding die-block, mounted on gibs, on the die shoe. From the punch-holder half of the die set, mounted on the press ram, a long

**Five ways to pierce rings . . .**

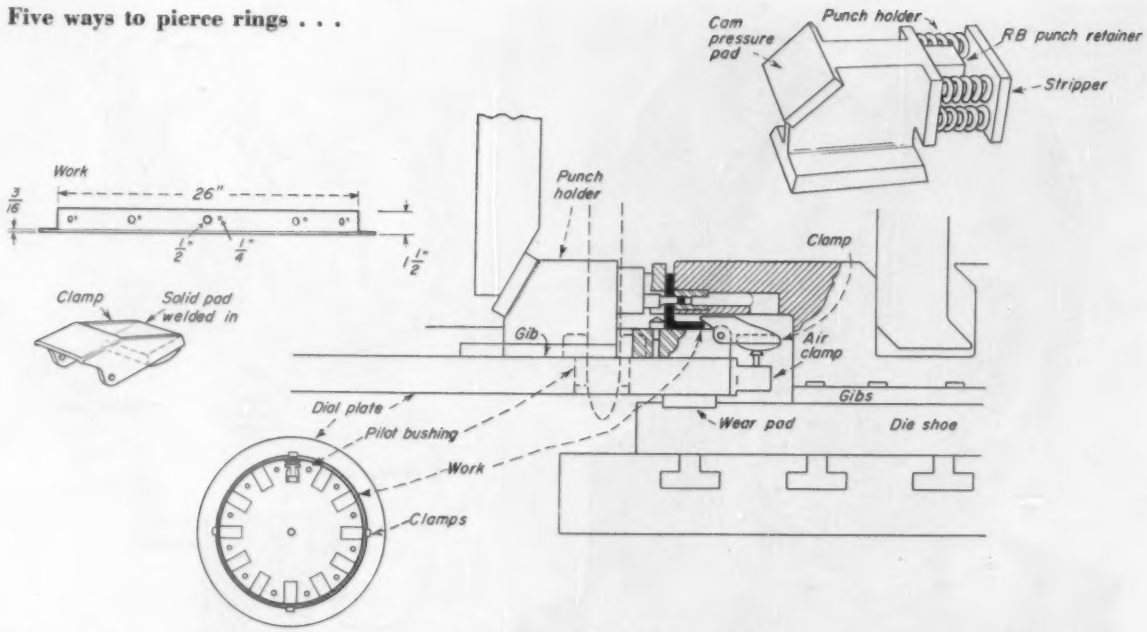
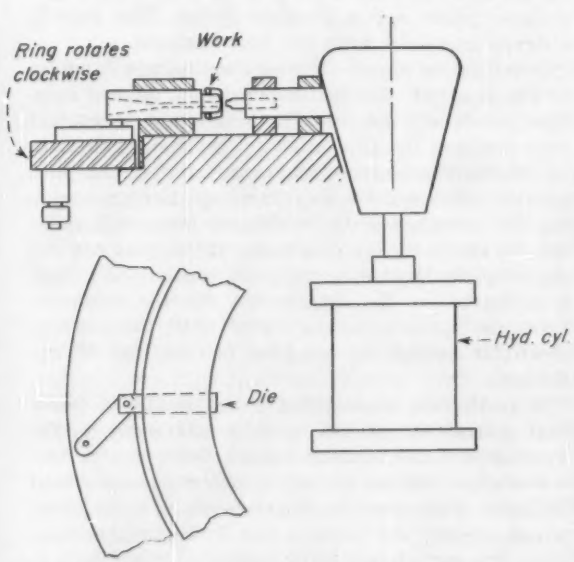


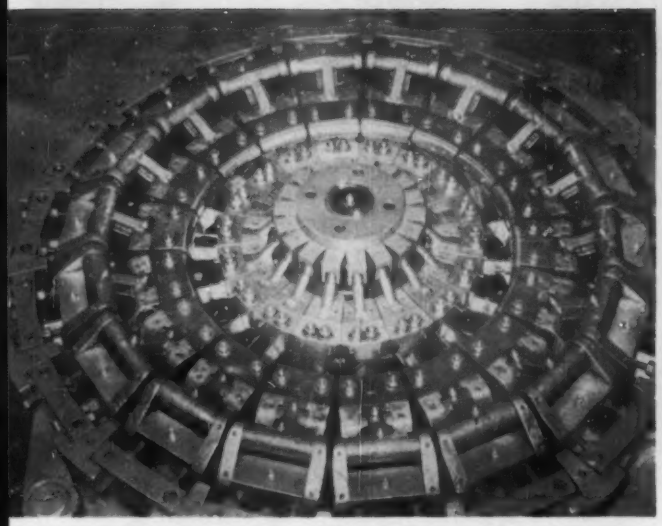

**FIG. 4 . .** A cam-operated punch holder is aligned with the die hole by means of a long bullet-nose guide pin at each index. A 12-hit counting control causes the press to pierce the 12 sets of holes and stop. Air indexing of the table, or dial, provides fast operation

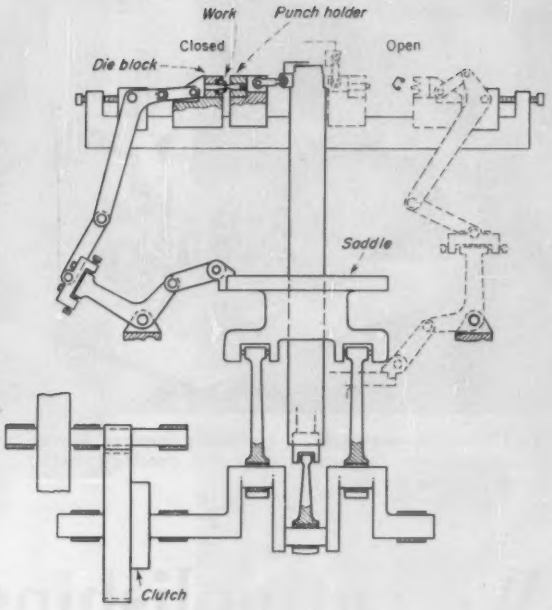
bullet-nose guide pin projects downward to engage a guide bushing at each punching station on the dial plate. This arrangement assures perfect alignment between punches and dies.

In operation, the ring is loaded and air clamped, and the 12-hit counting control on the press is energized. As the ram descends, the guide pin aligns the dial plate and a rear cam moves the sliding die block in against the outer side of the work. Further ram travel allows the front cam to engage the punch holder, moving it in and piercing one pair of holes. As the ram goes up, the springs in the stripper-plate on the punch holder cause the entire unit to bounce clear of the work about a 1/16th in., enough to allow easy unloading and loading. A heel on the rear cam withdraws the die block, the guide pin disengages the dial plate, and a trip on the ram activates the air-indexing cylinder. A friction brake




**FIGS. 5 AND 6 . .** A rotatable ring, moving clockwise, forces the 29 buttons towards the work, where they are held while the cone-shaped central plunger is pulled down by a hydraulic cylinder to actuate the punch holders






**FIGS. 7 AND 8 . .** All 37 holes in the ring are pierced at once in this special machine. A saddle, raised by two connecting rods, operates linkages to cause the die blocks to move inward. A central rod, actuated by another connecting rod, forces the punches outward. First the holes are pierced. Then, as the crankshaft passes the 180° point, the die blocks are moved inward once more to size the ring diameter by "setting" the metal

on the spindle of the rotating dial plate prevents overtravel from coasting. The cycle is continuous and automatic for the 12 hits, when the press stops and the air clamps relax.

### SPECIAL MACHINES

High production (1200 to 1500 pc per hr) combined with good precision (± 0.003 in.) is provided by automatic special machines which pierce all the holes in a workpiece at once. Two general types are employed, depending upon the nature of the work: piercing machines and combination piercing and shrinking machines. The former are relatively simple air-hydraulic units, Figs 5 and 6. The frame of the machine supports two fixed concentric rings on top, between which the work is placed. The inner ring has sliding punch holders, 29 in number, spring-loaded to keep them from the work. The outer ring has a like number of sliding die holders. Each die holder has a linkage which ties it to a third ring which is rotatable.

In operation, a foot valve is depressed, causing an air cylinder to move the rotatable ring, forcing the sliding die holders in against the work, where they are held while a large hydraulic cylinder mounted within the machine draws down a cone-shaped central plunger. Downward movement of the plunger causes the sliding punch holders to move forward, piercing the work. The plunger returns to rest, the punches are forced out of the work by the springs, and the rotatable ring returns, disengaging the dies from the work, which may then be withdrawn.

The "ultimate" in machinery for piercing rings is a battery of units which not only pierce 37 holes at ± 0.003 in. of location, but also size the ring diameter within 0.010 in. by shrinking, to "set" it to final dimensions. This machine is entirely mechanical in construction and is illustrated in Figs 7 and 8. In essence, the machine consists of a crankshaft with three throws; two in a common plane, and one 180° away. When at rest, the double throws are down, the single throw up. The double throws each carry a connecting rod fitted to a common saddle, which moves up and down on a vertical central tubular column. The saddle is the starting point for 18 sets of linkages which terminate on top of the machine on sliding die holders. The single throw on the crankshaft has a connecting rod, which operates a vertical member within the central column, to the top end of which are fitted simple linkages to 18 sliding punch holders.

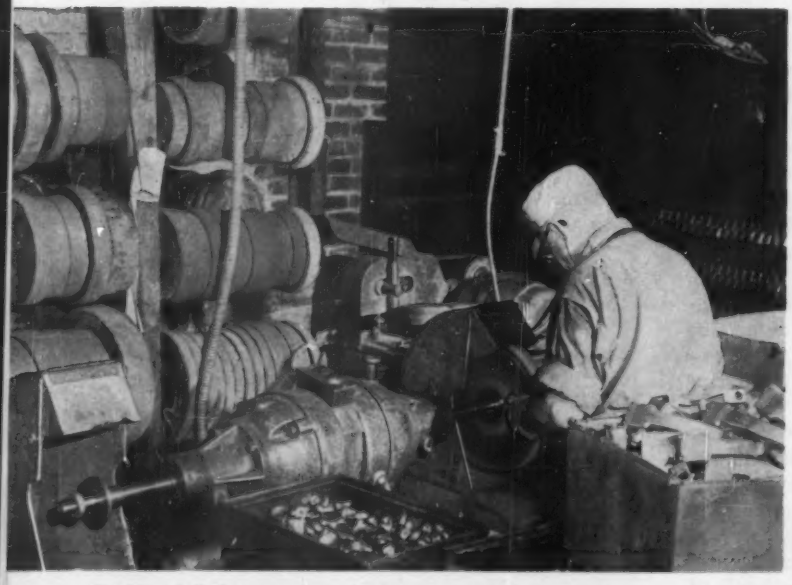
In operation, a pedal engages a one-revolution pin clutch, causing the crankshaft to rotate. The paired connecting rods force the saddle upward, causing the die blocks to move in. At a point just before full travel of the saddle, the die blocks reach their farthest inward position, compressing the ring. A small over-travel of the saddle permits the ring to relax slightly before the punches, forced outward by the downward movement of the central connecting rod, make contact with the ring and pierce the holes. As the crankshaft continues to rotate past the 180° point, the punches retract, the die blocks move in to compress the ring once more, and then return to their at-rest position. Three disappearing blades located between punches and dies locate and support the workpiece while the die blocks are not engaging it.

**1. Old-style manual . . .** polishing required a heavy inventory of setup wheels and belts, and necessitated a final cleaning operation to remove polishing compound from the work

# We cut polishing costs 35%

**Intricate contours, recesses, and undercuts are no obstacle to obtaining a fine, uniform finish**

A D VANDERBILT,
staff engineer
PORTER-CABLE MACHINE CO, SYRACUSE, NY



**3. Special fixtures . . .** hold housings for Routo-jig tools to prevent damage to surfaces during tumbling. Note the difference between acid-treated parts being racked and finished parts removed from the barrel

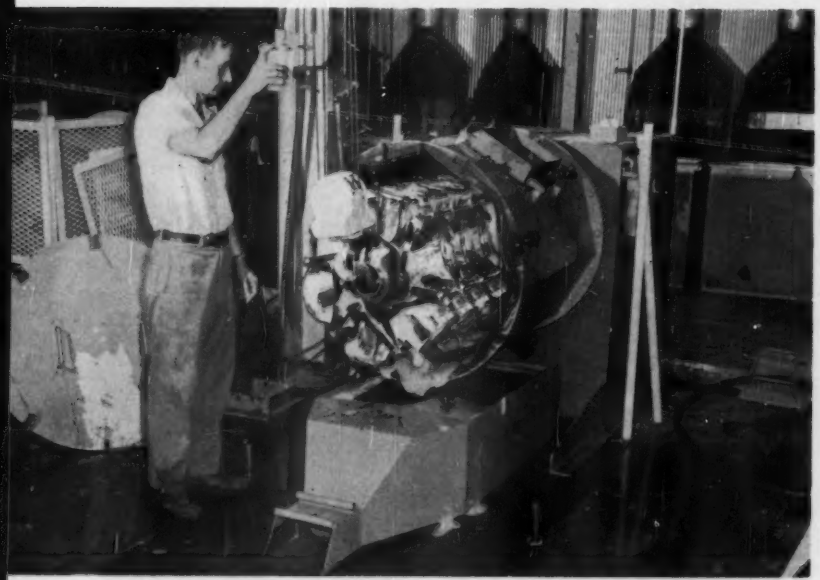
Manual polishing of die-cast aluminum housings for our line of portable electric tools has long been a thorn in our sides, and for many years we have tried to eliminate this high-cost operation. We tried automatic polishing, plating, acid dipping, and tumbling with varying degrees of success, but nothing met our needs until, about 30 months ago, we installed the Roll Brite process (patented) which involves dipping parts in acid and tumbling with steel burnishing balls and soap solution.

Results have been startling, and our total costs for license and equipment were recovered in 18 months of operation. Over-all cost savings over hand polishing have amounted to 35%, and savings on individual castings have ranged from 28 to 46%. Furthermore, we are now able to handle all our own polishing, instead of sending it out to other companies. The surface produced is quite unlike that obtained by conventional polishing or plating and might perhaps be described as a bright burnished effect. It is extremely resistant to finger marking and discoloration, and is uniform on both smooth and irregular surfaces. Fine detail and raised designs are not injured or distorted, and inside surfaces are as smooth and clean as outsides.

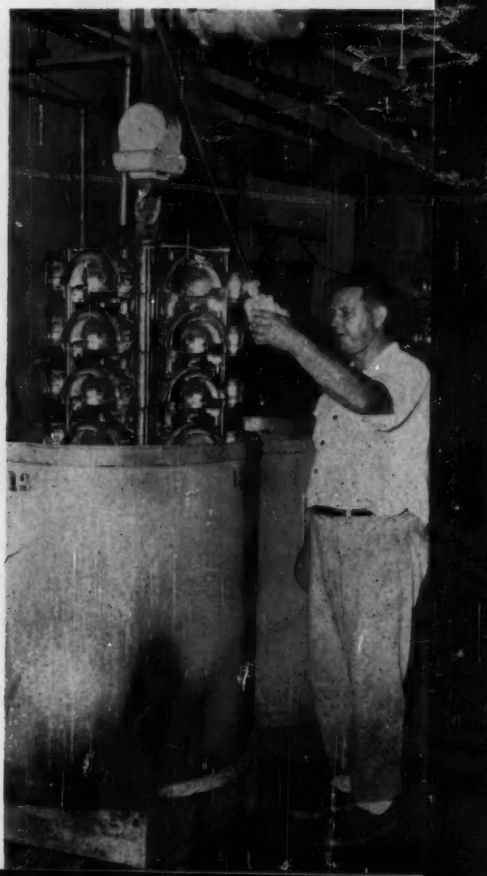
**2. New method . . .** permits handling parts in bulk for transfer through the various acid and water rinse baths, is easily operated by one man

An additional, but important, dividend has been that we have been able to redesign several of our housings for easier assembly and lower cost. On two tools, for example, we have been able to make the handles integral with the housing—something we could not do before because of the virtual impossibility of manual polishing the intricate contours.

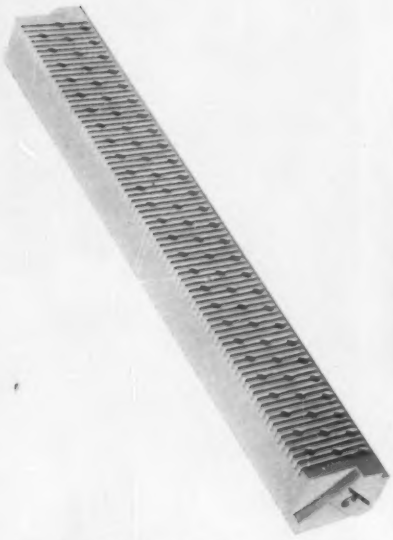
**4. Weighed quantity . . .** of steel Balcones and burnishing balls is loaded into tumbling barrel after fixtured parts have been inserted and soap solution added



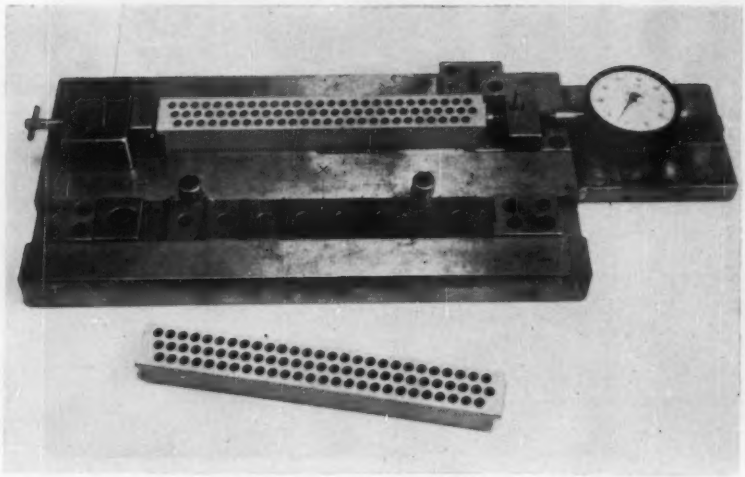
**5. Load of saw housings . . .** is removed after solution has been dumped. Chute below barrel has removable screen to trap tumbling media, is used as loading chute for the next load



**6. Hot-water dip . . .** serves to remove traces of soap solution, promotes rapid drying with no traces of water stain

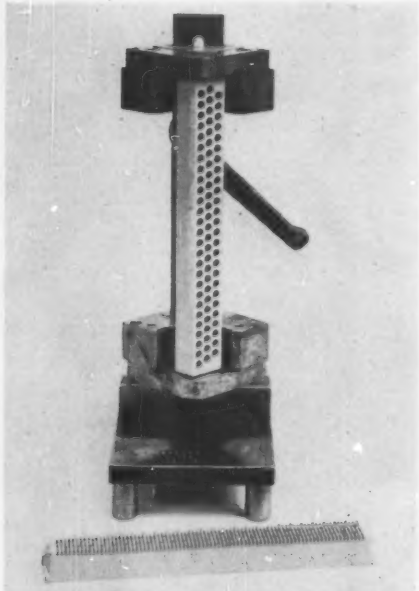


**Brush-holder block** with molded-in threaded inserts at ends presents a difficult molding problem because of accuracy required



**Length from centerline** to one end is held to ± 0.005 in. Blades at front of gage check nine slots for relationship within ± 0.005 in.

# Precision gages insure accurate plastic parts



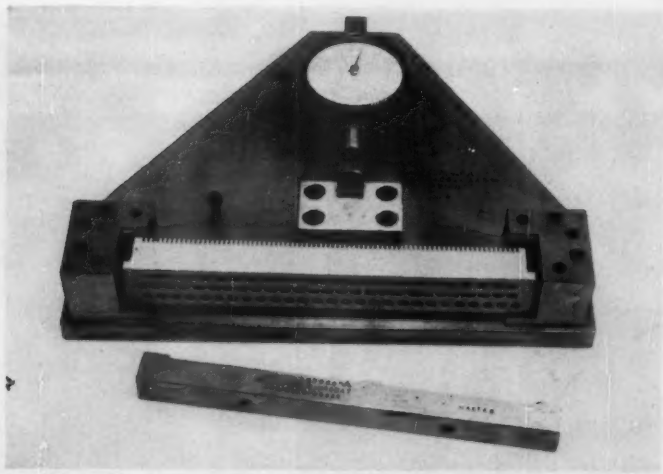
**Location** of threaded inserts in relation to sides and bottom of block is held within ± 0.005 in. and checked with flush-pin gage

**Plastic moldings are produced to limits normally associated with machining and must meet rigid quality-control standards**

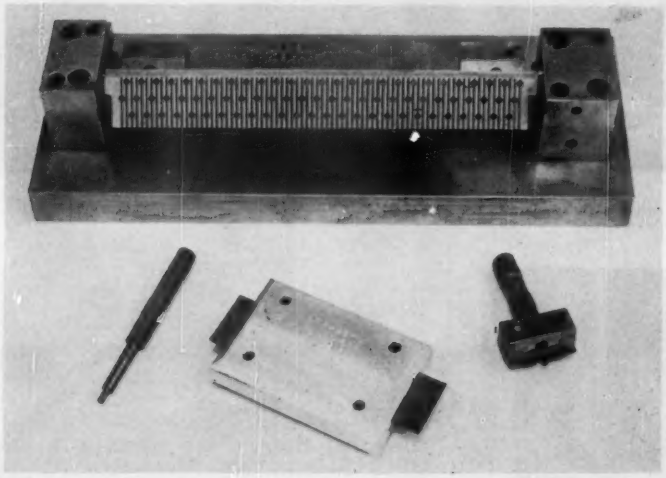
JOHN E DONOVAN, chief inspector,
AUBURN BUTTON WORKS INC, AUBURN, NY

Brush-holder blocks used to hold wire brushes in the IBM Document Originating machine for "reading" punched cards must be made to close limits to insure accurate operation of the machines. Originally, the blocks were machined from laminated phenolic, but this was expensive in both time and tool wear. Much better results are now obtained by Auburn Button Works by molding the blocks from glass-filled Alkyd which provides improved dimensional stability and higher shear strength for the fin separators.

Tolerance is maintained within ± 0.005 in. from the centerline to any one of the 80 slots in the top of the block, and the slot width is held to 0.038 in. + 0.003, – 0.001 in. Over-all length is held within 0.010 in., even though both ends are formed by side draws, and straightness is maintained by proper gating within 0.010 in. The new block is produced in a two-cavity, high-speed plunger mold and requires no machining but, as shown in the accompanying illustrations, a complete set of precision gages is required to insure interchangeability.



**Simple indicator gage** checks straightness within 0.010 in. Note master, foreground, used for setting indicator to zero



**Flush-pin gage** (rear) checks over-all length within + 0.010 – 0.000. Combination gage (bottom left) checks hole diameters to ± 0.003 in., and alignment of holes and counterbores to 0.004 in. Gage (center) checks width of individual slots to + 0.003 – 0.001 in., and special gage (right) checks alignment of slots and holes within 0.004 in.

IBM Revised 12-17-56 — QUALITY CONTROL - INSPECTION DETAIL — STANDARD SAMPLING

| | | | | | |
|---|---|---|---|---|---|
| PART NO. 849348 | MACHINE 514 | PART NAME BRUSH HOLDER BLOCK - 60 COLUMN | DEPT NO. 600 | DATE 10-25-54 | ENG. CHANGE NO. A77 A |
| OPERATION NUMBER 1 | MACHINE NAME HIGH SPEED REPRODUCER | | INSPECTION 15 | | |

MAJOR AQL 1.5% TABLE 1

| | | |
|---|---|---|
| 1. | Cracked, broken or damaged. | Visual |
| 2. | Width and depth of slots, .038, .110 dimensions. | Tool #130636 |
| 3. | Location of slots to each other. | Tool #126390 |
| 4. | Location of X-X to end, 3.706 dimension. | Tool #126390 |
| 5. | Location of slots in relation to .104 holes, see Blueprint Note 1. | Tool #126392 |

MINOR AQL 4.0%

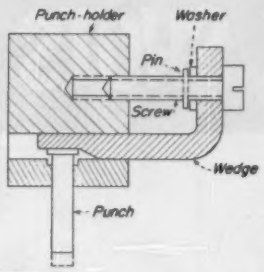
| | | |
|---|---|---|
| 6. | Depth of .104 hole, .219 dimension. | Tool #126393 |
| 7. | Hole size, .193 dimension and alignment with .104 hole. | Tool #126393 |
| 8. | Length of block, 7.461 dimension. | Tool #126391 |
| 9. | Location of insert in relation to .500, .313 dimensions. | Tool #131116 |
| 10. | Straight within .010 dimension, Blueprint Note F. | Tool #127589 A |
| 11. | Thread size of inserts, 5-40 dimension. | Thread Gage |

METHOD INDICATED BY ASTERISK MUST BE USED — COPIES IN DEPT.

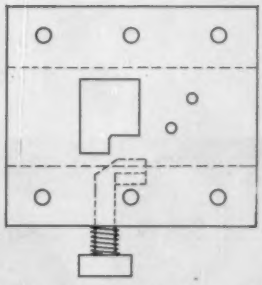
**Quality-control** card lists major and minor dimensions, specifies sampling method and identifies gages to be used

# Diemakers Kinks

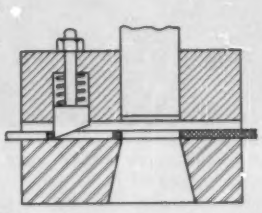
FEDERICO STRASSER




**PIERCING PUNCHES** can be made inoperative, when desired, by retracting a wedge. Then, when another product calls for the pierced hole, move the wedge in by means of the adjusting screw.

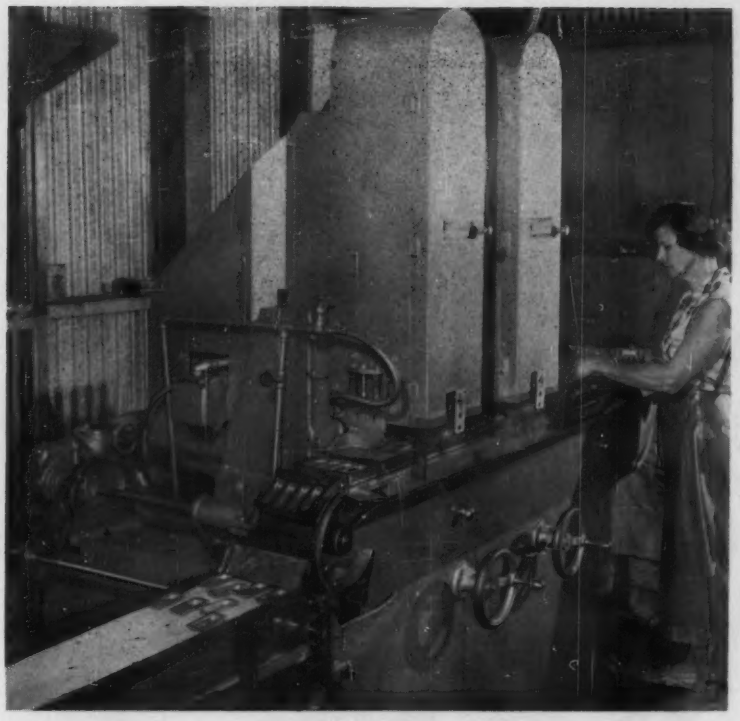


**MANUAL** starting stops may interfere with a clamping screw or dowel pin in the stock gage. To avoid this, make the stop in a L shape to clear the hole or obstruction.

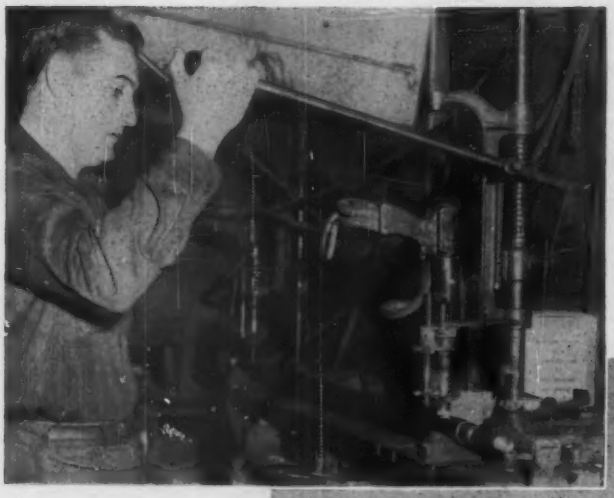


**SEMI-AUTOMATIC STOPS** for blanking dies eliminate the need for lifting the strip over an ordinary stop pin. As the strip is pushed forward, the scrap bridge lifts the stop. The stop, when it clears, then drops back into the blanked opening, and the strip is pulled back until the bridge contacts the face of the stop.

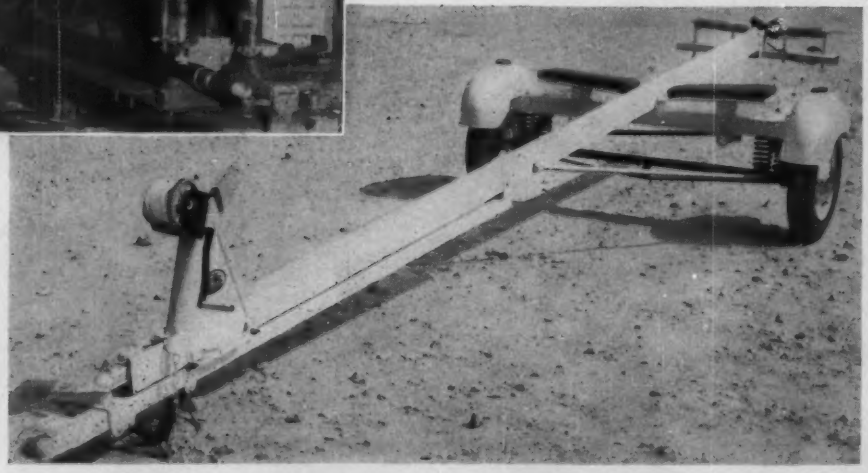
# SHOP SHOTS

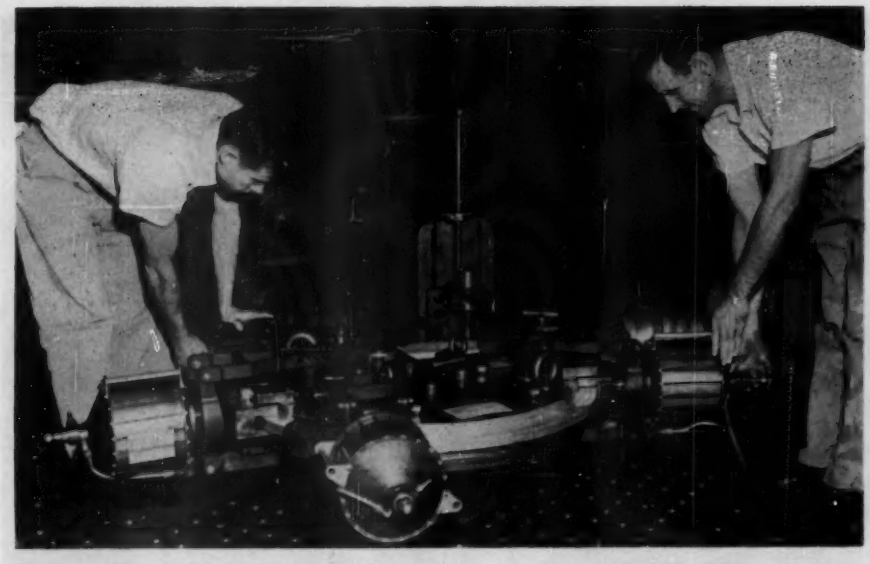


**Molded conveyor belt** carries brass escutcheon plates under two abrasive-belt heads that rough and semi-finish the parts. Plates are finished at 3600/hr, ten times old rate for manual buffing. Color buffing has been eliminated by semi-automatic cycle. *Engelberg Huller Co.*

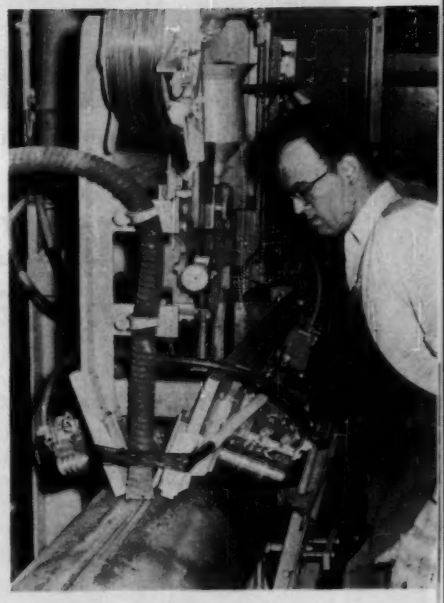


**Studs are end-welded to axles** for boat trailers to secure springs. Bench drillpress fixtures hold Nelson stud-welding guns over work. Result is clean design without through holes and bolts. Special studs are also welded to winch attachment added to trailer. *Tee-Nee Trailer Co, Youngstown, O.*

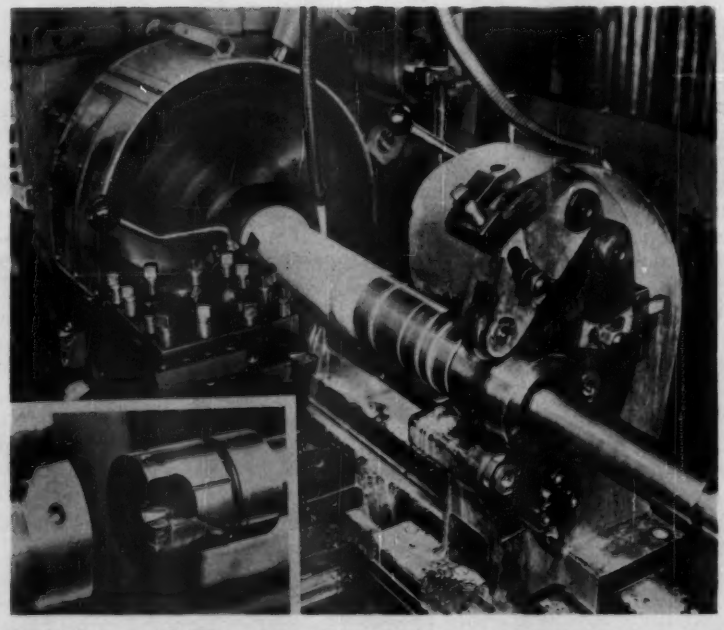




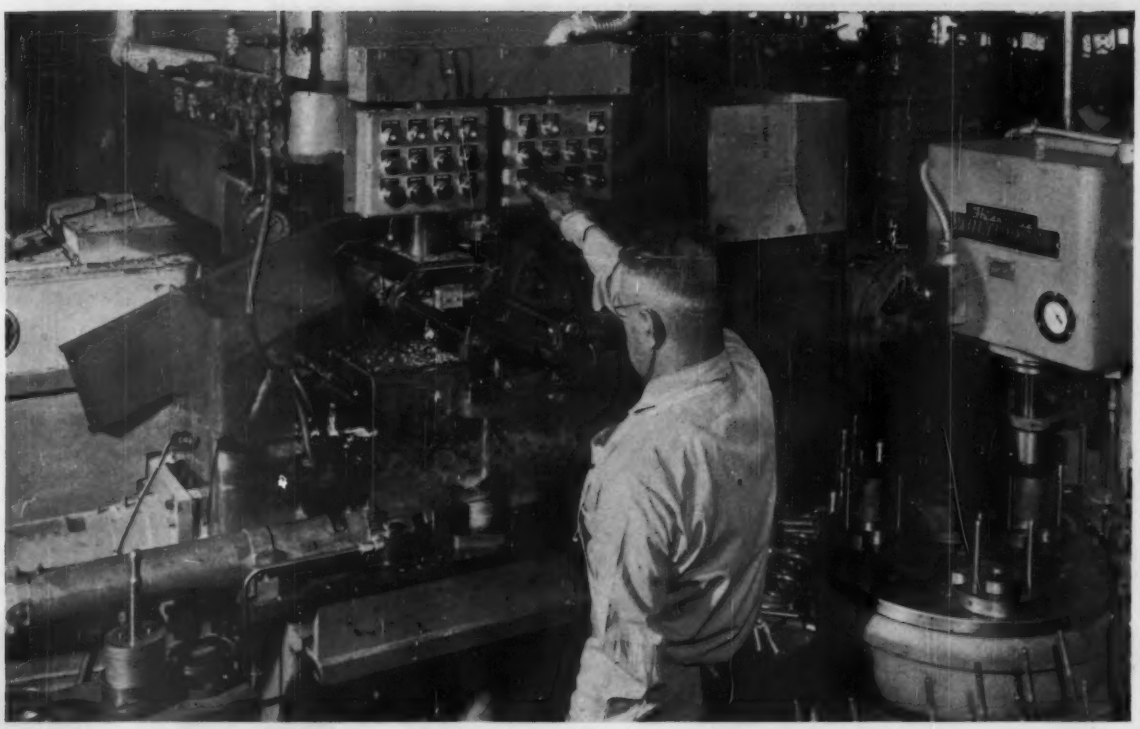
**Four universal joggling attachments** added to Cyril Bath stretch-forming machine produce special shapes on flange of aluminum part while it is being stretched. This eliminates contour deformation that would otherwise call for hand refinishing. Attachments work from line air pressure and anchor in holes near edges of stretch-forming die. *Chance Vought Aircraft, Inc, Dallas, Texas.*



**Continuous seam welder** seals up shells for glass-lined water heaters. Linde equipment is controlled by limit switches to pass shells one after the other through argon-shielded sigma welding fixture. Sheets are 10 to 14 gage, and are welded at 100 ipm with little hand finishing required. *Rheem Mfg Co, South Gate, Calif.*



**Carbide gun drill** bores centrifugally cast iron oil-well packing, taking out ⅜ in. of stock on the ID in one pass. While gun drill works, OD is finish-machined and an 8-in. length is threaded by tool behind turret handle. Threading and gun drilling are done with Caroboloy 883 tools. Drill life is about 500 lineal ft of hole per grind. *Baker Oil Tools, Inc, Los Angeles.*



**Press combined with die-casting machine typifies advanced production concept when . . .**

# *STREAMLINED LAYOUT sparks multi-story operation*

CHARLES EMERSON,
associate editor

Weathered bricks outside Westinghouse Electric Corp's East Springfield, Mass, multi-building appliance plant now shelter a reorganized network of interconnected conveyors that sense the right time to feed parts, plus new assembly lines with mechanized equipment.

An example of the smart tooling that makes the setup as efficient as many brand-new showplace shops is pictured above. Rotor laminations are assembled by die-casting aluminum through the rotor slots on this combined machine. The operator stacks laminations on a fixture and places the assembly in the machine. The press forces the fixture down into the casting well, filled with molten aluminum, where the rotor cools until the aluminum is solid. Then the machine ejects the assembly and sends it down a chute to a horizontal press that strips out the fixture. The rotor is conveyed on to a cooling tower, and later to a honing machine; the fixture is returned to the combination die-caster-press.

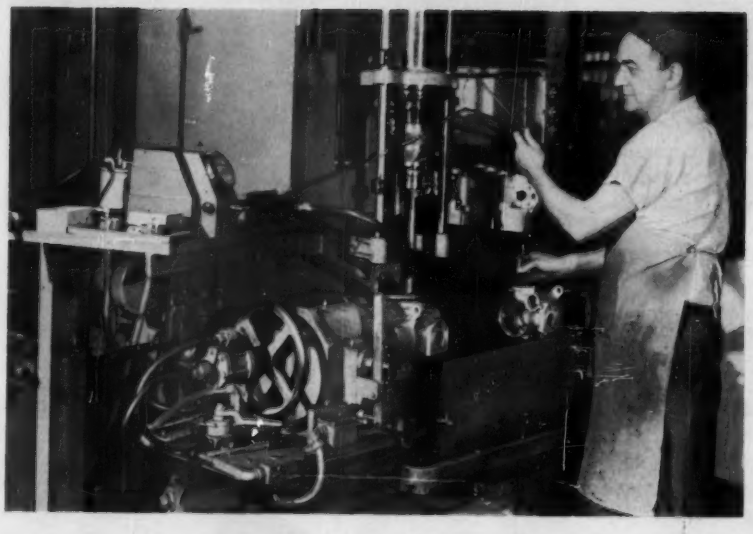
**NEW EQUIPMENT**

When the Columbus, O, plant took over refrigerator production in 1953 (*AM*—May 10 '54, p157), space left behind at East Springfield was available for a product Westinghouse had been planning for some time: "Streamliner" air conditioners. The new line is just getting into two-shift stride at about the time of the windup of a major over-all plant rearrangement that also affects production of vacuum cleaners, fans, and food mixers.

Changes have been going on for some time. A huge copper-nickel-chrome electroplating system has been installed to finish "show" parts for all appliances made in the plant. It plates at 500 sq in./hr and operates automatically. Only personnel required outside of operators for control and maintenance are for loading and unloading the complex equal-plated-area parts-carrying racks.

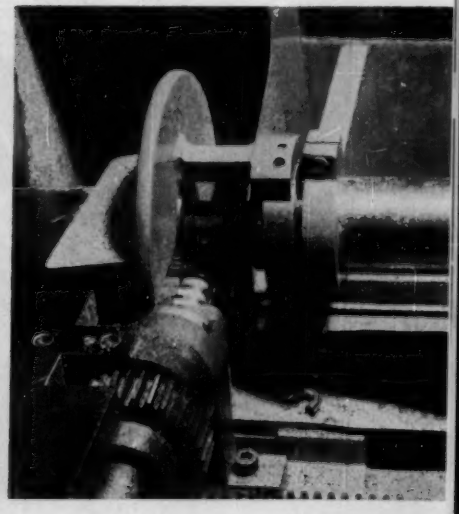
Another more fundamental change is the installation of eleven storage and marshalling conveyor systems, each of which includes at least two live-roller conveyors. Each system serves an assembly line for one type of appliance, and gathers and stores packaged units until a half hour's production is batched. Then, when the feeder conveyor is clear, automatic controls release the batch to the main belt conveyor that carries the units to the shipping building. Ap-

**Compressor-motor housing is cast . . .**
around CI cylinder sleeve inserted into single-cavity die by operator. Machine ladles automatically, allows casting to cool, then ejects it to rear where chute carries housing around machine to flash trimmer (left). Operator meanwhile trims housing previously cast and sends it on to barrel tumbler



**Cylinder bore is honed and checked . . .**
by operator at machine. All machining stations have gages set to masters (on table, left) that allow operators to check as closely as inspectors. Air gages are installed where practical. After bore honing, housing is checked in fixture that verifies all surfaces. Parts are washed, then moved to assembly room

**Electro-limit tube bender . . .**
operates semi-automatically to form several heat-exchanger tubes with integral bends at end. Operator feeds three lengths of stock; machine trips when stock hits limit switch. Bend is made, then abrasive cutoff wheel trims ends of bends square—operated by another switch tripped when stock has completed bend



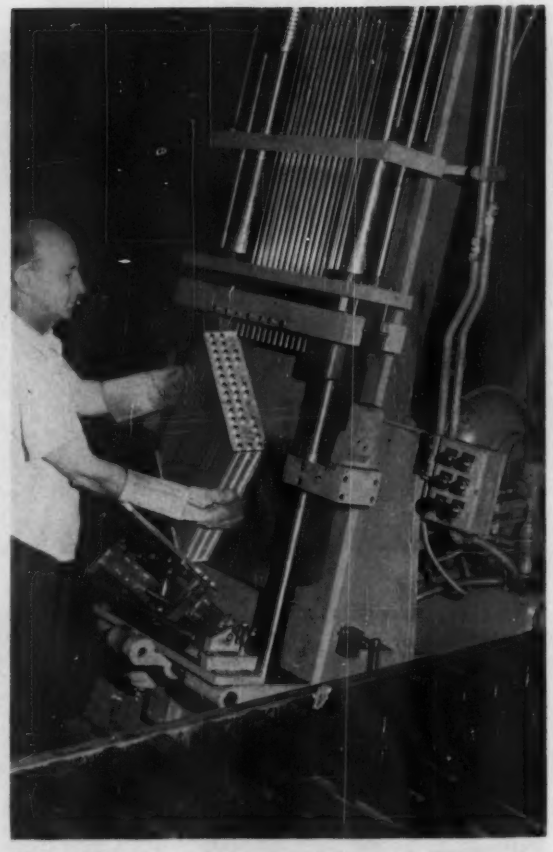
## STREAMLINED LAYOUT
### *sparks multi-story operation . . .*

pliances are received there in practical-size batches, not intermingled or mixed.

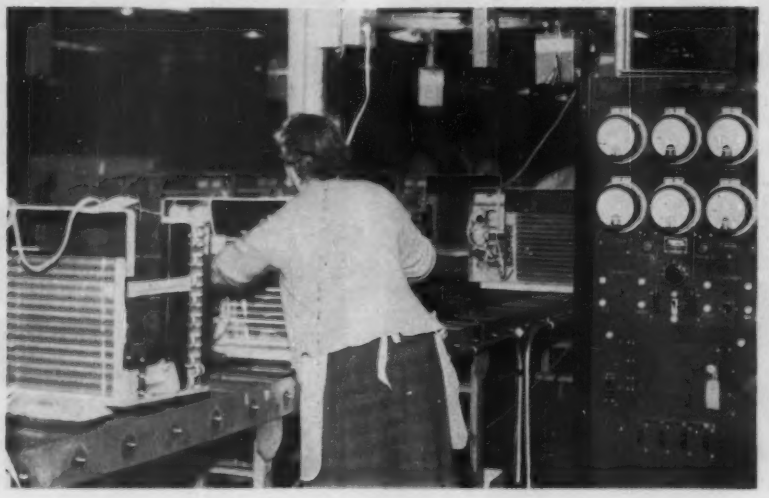
**AIR CONDITIONERS**

The line for dehumidifiers and air conditioners—both "Streamliner" and conventional models—represents careful top-level production planning that considered several modes of production and several product designs.

- Automation—considered and rejected on the basis of capital investment vs production rate. Setting up a straight flowline with all special machines could not be justified, especially because high production could be attained by another method. . . .
- Mechanization by operation—the accepted production plan, based on full utilization of reasonably standard machine tools with a number of special additions and adaptations. These are connected where possible with parts-handling equipment—chutes, ejectors, belts, and the like—that can store small quantities of parts temporarily. Machining operations on the die-cast parts for the compressor are highly mechanized; where operators are necessary to load and unload difficult-to-mechanize machines and fixtures, they also make important inspections of the work in progress.
- Aluminum die castings—adopted for the compressor-motor housing, piston, connecting rod, cylinder head, and outboard bearing. Die castings were seen to be the coming thing, after several years of experiment and test. But instead of waiting, engineers tested prototype and sample parts cast in a copper-aluminum alloy that showed excellent bearing properties. Results were as good or better than with other cast or fabricated parts, and the decision to turn to die castings immediately was made. One immediate result was that only about a fifth of the normal investment was required to set up the production line. Less machining is necessary, casting quality is more uniform, and costs per piece are lower.



**Fin-and-tube assembly for heat exchanger . . .** is completed at press with multiple punches, each of which drives a tube through the stacked fins. Spacing between fins is held by flares formed at holes in piercing operation. Assembly is locked by flaring collar around each punch, which expands tube end so it will accept bent tube connector

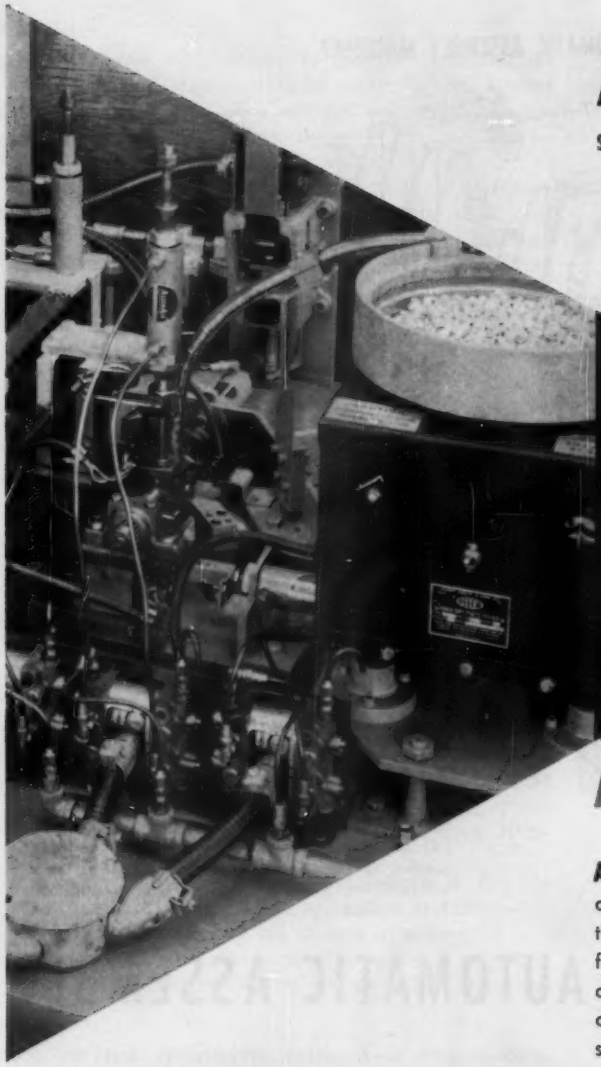


**Complete operational test . . .** is made as units come down roller assembly conveyor. Overhead chain conveyor carries electrical boxes with leads that connect to units. Boxes make contact overhead with shoes that hook up to test panel (right) where instruments yield ratings

**American Machinist**

SPECIAL REPORT NO 443

# WHAT'S HOLDING BACK THE AUTOMATIC ASSEMBLY MACHINE?



the need:
STANDARDIZATION

Automatic assembly machines save about two-thirds the cost of assembling small and medium-size products by hand. More than 160 industries would like to use such equipment with from 10 to 30 stations. Much has been accomplished in the development of the machines (see bibliography), but each one is now almost tailor-made, with the exception of a few standard machine tools now commercially available. Adoption of automatic assembly and the related sequence-machining equipment would get a boost through a modicum of standardization. For example, a standardized width of tooling station would enable any machine builder to get into the manufacture of a line of tooling attachments. These attachments are actually machines that are mounted in proper order at the tooling stations to perform the desired operations — insert, rivet, form, mill, slot, saw, weld, etc. Probably 250 different kinds of these attachments will be needed. Today, we have standard-size machine tools, presses, etc, in infinite variety, but only a few kinds or sizes are really suitable for production use in a "bench" type of mounting. When we get an engineered line of tooling attachments, the automatic assembly or automatic sequence-machining unit will move into Metalworking in a big way.

**GEORGE H KENDALL, Sr,** president **JERRY A HOST,** vice-president
**GEORGE H KENDALL, Jr,** treasurer **KENHOS CORP, NORWALK, CONN**

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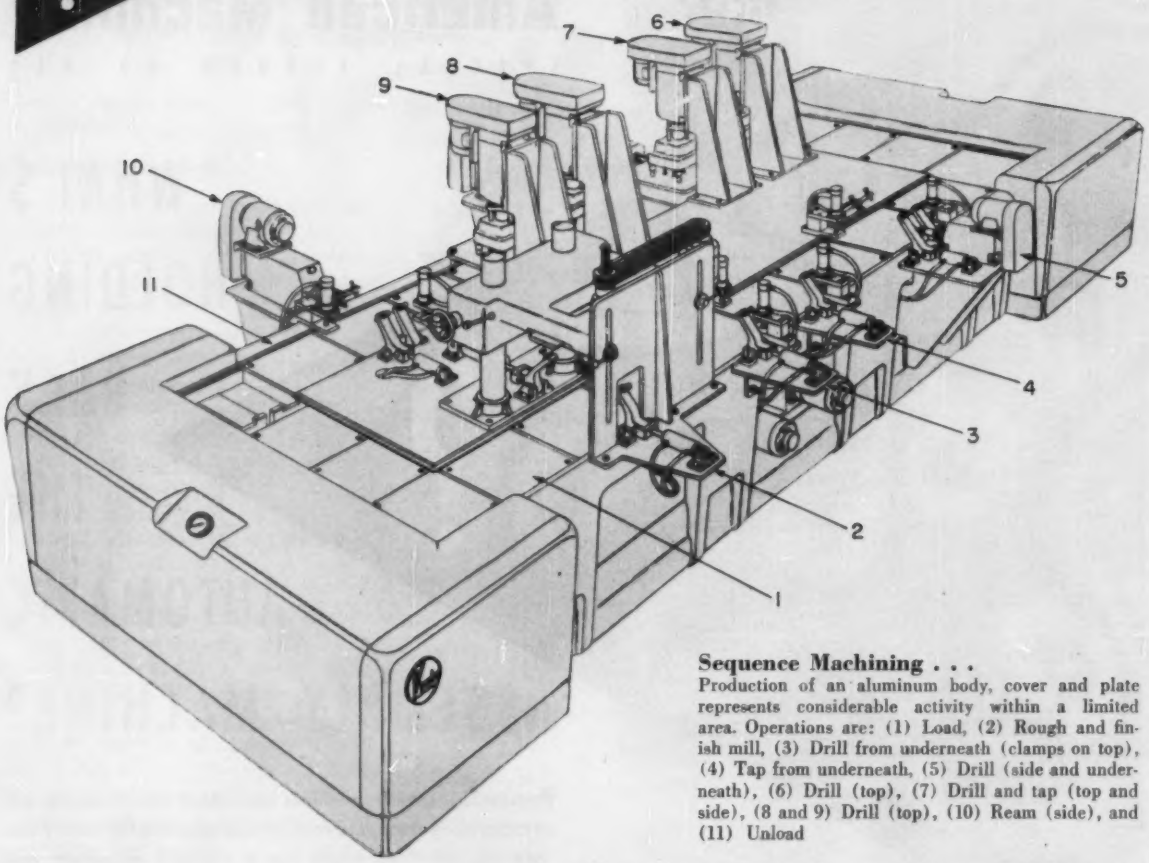
WHAT'S HOLDING BACK THE AUTOMATIC ASSEMBLY MACHINE? . .




**Sequence Machining . . .**
Production of an aluminum body, cover and plate represents considerable activity within a limited area. Operations are: (1) Load, (2) Rough and finish mill, (3) Drill from underneath (clamps on top), (4) Tap from underneath, (5) Drill (side and underneath), (6) Drill (top), (7) Drill and tap (top and side), (8 and 9) Drill (top), (10) Ream (side), and (11) Unload

# *Cost and savings of* AUTOMATIC ASSEMBLY

The time has come to achieve truly balanced equipment for automatic assembly of small mechanisms (4 to 20 parts) and also for the automatic sequence-machining of small parts. This is a broad field. For every auto-engine plant with its huge transfer machines and automation devices, there are hundreds of companies that produce small products *in volume*. By modern concepts, it is costly to make these small parts on single-operation equipment and assemble them by hand.

In terms of productivity per unit of floorspace, the automatic assembly machine or the sequence-machining unit will produce far more than is possible with single-operation equipment. Experience shows that it is economical to replace hand work or single operation machines with a tooling attachment when the latter costs from 1 to 1½ yrs wages. The investment can run as low as $2200 per tooling station for simple tooling but normally falls between $4500 to $6500 per station. A fair average for discussion purposes is $5000. The basic machine to receive the 10 to 30 tooling attachments will cost from $2000 to $3000 per station, including drive and electrical controls. Hence, we are not talking "peanuts" with respect to machine investment, but we are talking about equipment that will save two-thirds the cost of customary methods.

Over the next 5 to 10 yr the cost of tooling automatic assembly machines will remain high, because of development expense. Labor costs for engineering, manufacturing and assembling the equipment range from 4,000 to 8,000 manhours for 10 to 20-station machines. But enough experience has been gained in the field to point out the areas where a degree of standardization will in the future expedite design and delivery of equipment, and in addition greatly broaden the applications.

Progress will also be made in proportion to the efforts of machine users to understand applications . . . how to supply supporting services . . . and how to develop new product designs suitable for automatic assembly.

### PRODUCTS SUITABLE FOR AUTOMATIC ASSEMBLY

General studies indicate that the range of parts within one subassembly will run from 4 to 20 parts. Some have distinctive subassemblies that go together to make up the final assembly. Others have

no clear-cut mechanisms to make sub-assemblies but require a large number of parts per unit assembly. Where these parts are not unitized to go together as a sub-assembly, design of tooling attachments may be prohibitive in cost.

Further study tends to show the need for machines capable of automatic assembly of a few parts, that is, sub-assembly jobs. These jobs may require only an assembly machine composed of a few tooling attachments. Experience dictates that limiting the number of operations of assembly on one machine to the range of 12 to 20 items will give better performance in terms of reasonable downtime.

#### MACHINES AVAILABLE NOW

Two types of automatic assembly machines are commercial entities: the straight-line, or in-line, type, and the turntable, or dial, type.

Straight-line machines are made in lengths of 8 to 30 ft. A new straight-line machine, just making its appearance, is the four-side model that will compete successfully with the round turntable models. The larger machines are usually single-side models with widths of 30 to 36 in. The work-nest pallets progress along the machine, and the empties are returned underneath. In another arrangement, the double-side model, the pallets move in a rectangular path around the periphery of the machine, which is 48 to 60 in. wide. Double-side machines provide about double their length in effective tooling space. Straight-line machines are built by Ferguson, Kenhos and Swanson.

The straight-line assembly machine is flexible for work-size change and provides the maximum degree of accessibility to all tooling attachments.

The round turntable type of machine is also employed for multiple-station service. This type has less length than the straight-line machine but takes about the same floorspace. It is limited in number of tooling stations that can be placed around the circular table. Its size is generally limited to 4 to 16 stations for tooling attachments, and results in a machine of 6 to 10 ft. dia. Round turntable types include the Ferguson, Multra, or Swanson makes.

#### FUTURE NEEDS IN MACHINES

Existing machines have already reached a high state of engineering, but for the future certain developments are necessary, if the benefits of automatic operation are to be enjoyed by many shops.

The basic need is for standardized machines that will provide all basic functions for the widest range of application. In fact, several types of machines will be required:

(a) The heavy-duty, all-purpose machine for both automatic assembly and automatic sequence machining.

(b) The light-weight machine used solely for automatic assembly.

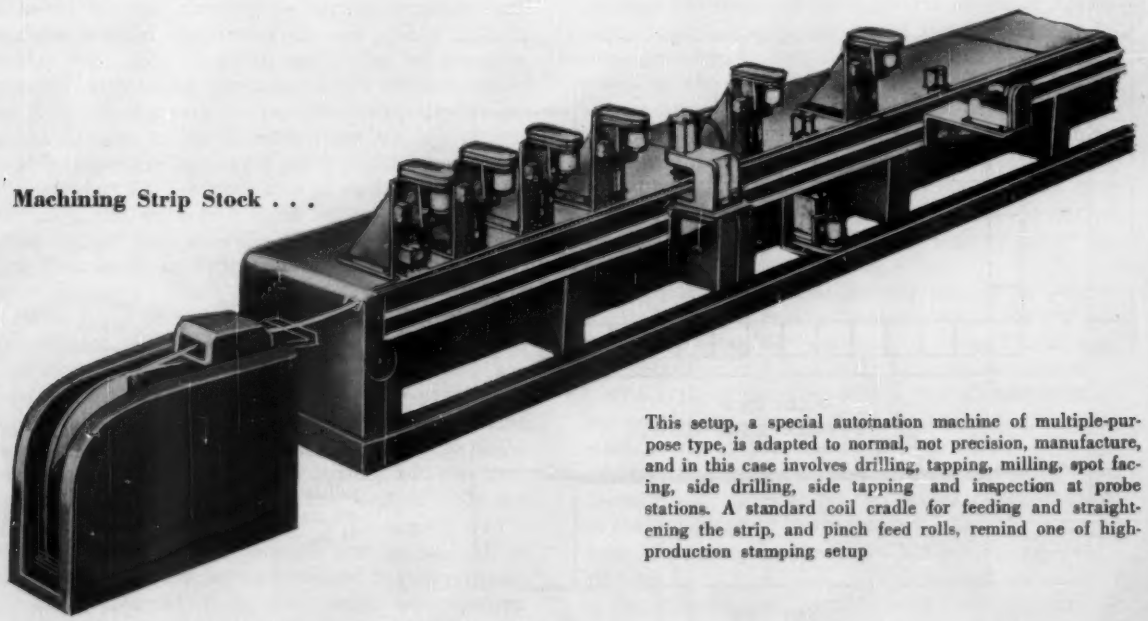
(c) A short-run production assembly machine having the general facilities for the mechanical bench assembly class of work.

(d) A series of tooling attachments tied together in electrical timed actuation but without a "machine tool" base structure.

Where assembly or sequence machining operations require from 20 to 60 or even 80 steps, straight-line transfer machines of modular construction can be employed. Sections, or standard units, may be bolted together for any required length.

All electrical, pneumatic or other controls throughout the machine should be accessible for inspection, repair or replacement. Quick-disconnect couplings are desirable for air lines, and multiple

**Machining Strip Stock . . .**



This setup, a special automation machine of multiple-purpose type, is adapted to normal, not precision, manufacture, and in this case involves drilling, tapping, milling, spot facing, side drilling, side tapping and inspection at probe stations. A standard coil cradle for feeding and straightening the strip, and pinch feed rolls, remind one of high-production stamping setup

wire or cable connectors for ease of changeover. Close attention to JIC standards is recommended.

### ADAPTABILITY OF MACHINES

An automatic assembly machine, or automatic sequence machining equipment, must be able to do any assembly or machining job when proper tooling attachments are set up to operate in timed sequence. The machine should provide for complete electric control with electric plug-in connections at each station location for connection of tooling attachments.

It is difficult to plan for the exact number of stations required for the average tooling job. Experience may show that an additional station is desirable. Therefore, allow one idle station for every four work stations, when selecting the machine capacity.

### ACCURACY OF MACHINES

The accuracy possible for automatic assembly ranges from ±0.001 in. with well registered tooling to ±0.0002 in. with super-precision tooling. For general practice, ±0.003 in. can be normally made available. Tooling fixtures for automatic assembly are generally more expensive than for automatic-sequence machining. And a problem is to "debug" them in order to secure perfect repetitive functioning.

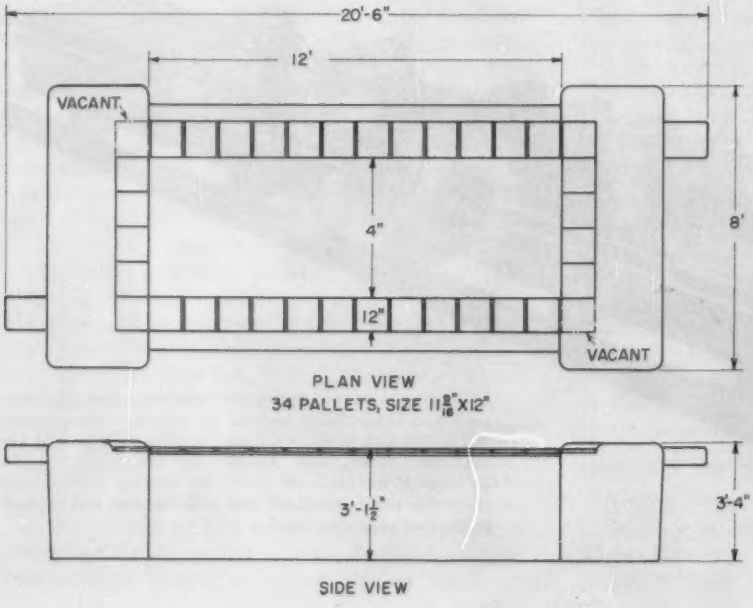
Automatic sequence machining will, in general, require more precision than automatic assembly, but the fixtures will generally be less expensive. Production accuracy of ±0.001 in. to ±0.0002 in. can be realized on machines of sturdy construction if skilled engineering is applied. However, ±0.002 in. to ±0.003 in. will be average practice.

There is a standard automatic transfer machine now available that has the required fundamental register lines and surfaces throughout its entire length. This feature enables precision setting of all tooling attachments to the basic $x$, $y$ and $z$ coordinates in order to maintain uniform accuracy in production.

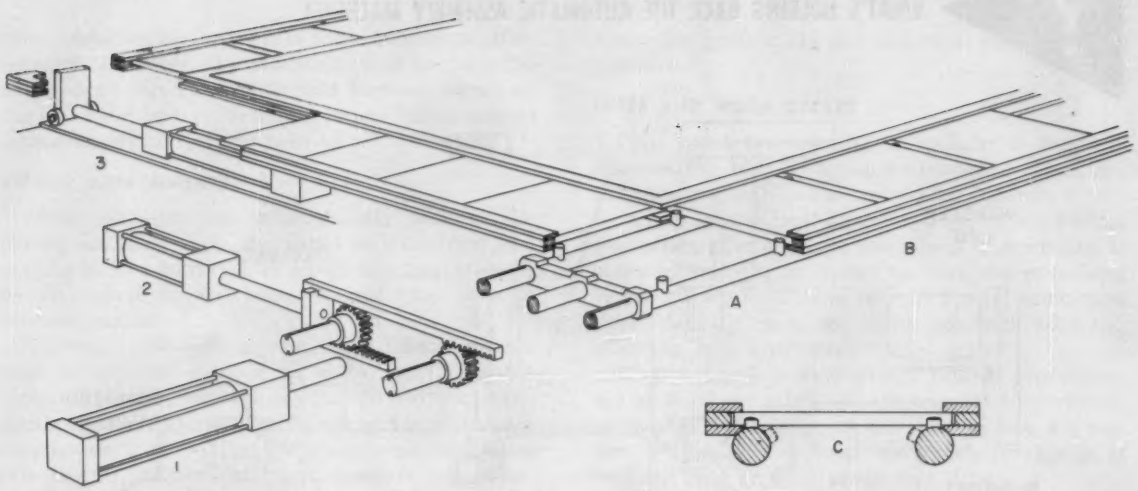
### REQUIREMENTS FOR PALLETS

The work nest or pallet should allow the work to be accessible from all sides. Usually the pallet of the straight-line machine provides a greater accessibility than the work nest of the turntable machine. Ready access to the work is needed, for example, on electronic printed-circuit boards, where parts are mounted on both sides, and on hardware assemblies where the same assembly sequence is essential on both sides.

In the dial type or chain-driven in-line machines, the same side of the work nests or pallets is always nearest to the tooling attachment. In the horizontal-hitch feed type of machine of the double-side type, the work nests or pallets keep the same "compass position" all around the machine. This feature provides for lower tooling costs for parts requiring the greatest degree of accessibility from all sides. That is, the pallet side nearest the tooling on one side will be farthest away from it on the opposite side of the machine. Turning of the track at the corners enables one to put tooling attachments on the top




**Basic Transfer Machine . . .**
The high-production type of assembly or sequence-machining unit has pallets that travel in a rectangular path. Ductile-iron pallets (for rigidity and wear resistance) are made in modular widths of 6, 12 and 24 in.




**Pallet-Advance Mechanism . . .**
A hitch feed is used to advance pallets. The mechanism shown is duplicated at both ends of the machine. Cylinder 1 pushes pallet from corner position *A* along side of machine one step to position *B*. Cylinder 2 rotates transfer bars to engage and disengage drive pins, as at *C*. Cylinder 3 moves pallet across end of machine to fill empty corner. Here the pallets are shown in gibs. Another design incorporates a trough and removable pallets

deck rather than to use overhung or off-machine tooling, which is always more expensive.

The pallets can be built for mounting single or multiple nests or centered or offset work nests.

The pallets operate best if they travel in predetermined machined ways or tracks of known location. Parallel machined surfaces, grooves, keys or corner angles on the machine base or top deck surface enable accurate setting of tooling attachments with the centerline of pallet travel. It is usually desirable to have one or two parallel machined surfaces at either side of the pallet line of travel. Thus, known locations are available throughout the machine.

Unusual operations are often met. For example, a heavy coining, riveting or flaring operation will require a rigid supporting column placed directly under the pallet. Prior to application of pressure, a toggle jack raises the pallet a few thousandths of an inch off the rails to provide free support and avoid damage to the transfer machine.

It is important to have a rigid, positive and accurate support for the work nest at each station. Presumably, the work nest must be supported at both sides rather than overhung at one side—a condition that leads to deflection when pressure is applied.

Some types of multiple-station transfer machines are affected by problems of size or length. Drives that move work nests or pallets by chain or belt are subject to stretch, which affects proper positioning at stations. Locational problems are avoided if the tooling attachments cause shot pins to engage bushings in the pallets or work nests. Pallets can then be allowed to float ±1/32 in. and depend upon the shot pins for registry.

The horizontal pallet or work nest lends itself to easy loading, and it can be arranged to ride on rails, suitably protected from dirt, chips and coolant. Further advantages of the horizontal placement are lower costs of associated tooling, the availability of a wide variation in supporting shapes for the work, and ability to perform operations from all positions—top, sides or underneath. In cases where much pressure is applied, a suitable clamp or chuck can be applied in the work nest or pallet. In other cases, rotating, turning or trunnion units can be built in.

### SPACE FOR TOOLING ATTACHMENTS

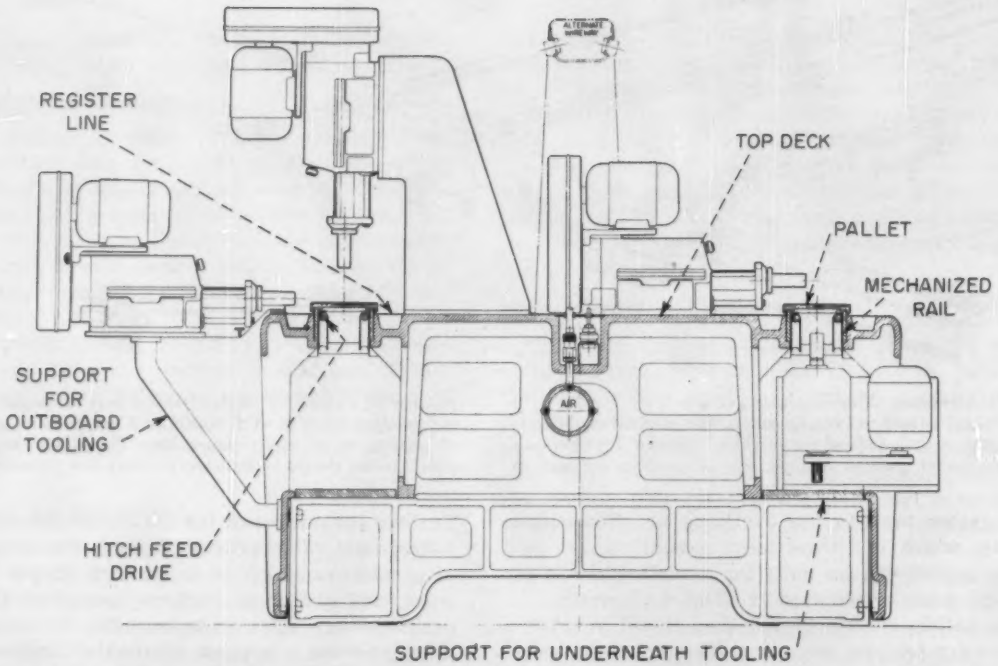
Each tooling attachment requires ample space all around for free access. The work nest, or pallet, is usually located at one end of the attachment, the attachment controls at the opposite end. Feeding devices are sensitive to slight variations in dimensional and surface qualities of the parts being fed and to foreign matter. Easy access must also be provided to the feeder control knob and the feeding compartment. There must be bench space for a box to receive parts from a feeder in case of a jamming, off-tolerance or dirt problem. Escapement and positioner mechanisms at the work nest or pallet must also have clear working space to remove or correct for jamming conditions and for observation of operating performance.

Room is also needed around machining attachments to change dull or broken tools or for tool adjustments or attachment control. Delays from poor accessibility can enormously increase downtime.

The type of machine affects the allowable space per tooling attachment. The dial-type machine has work nests at the rim of the turntable with the tooling attachments located radially outwardly from them. Proper space at the rim causes excessive space at the outer end of the tooling attachments. The dial type of machine is therefore limited in number of stations.

The straight-line machine with work nests at the

## WHAT'S HOLDING BACK THE AUTOMATIC ASSEMBLY MACHINE? . .




**Machine-Tool Type Construction . . .** Welded base with accurate register surfaces and edges is used for both assembly and sequence-machining setups. The pallets ride on magnetized rails in this instance, and positive precision-register clamps are used too when sequence machining. An air receiver runs length of machine

center and with the tooling attachments at the edges also poses problems of accessibility and spacing.

The straight-line transfer machine, single or double sided, provides a practical solution when work nests or pallets move along the edge of the machine, and the tooling attachments are on a top deck inside the line of work nests or pallets. The spaces are all rectangular, not wedge shaped, and assure free access. Flat machined surfaces should be available all about the work nest or pallet for rigid mounting of all types of tooling attachments.

What is the proper operating space per station for practical production service? In the United States, the dimension ranges from 30 to 36 in. Probably, time will show that practical accessibility for both operators and attachments can be assured with a spacing of 30 in. per station if hand operations are involved. Certain types of automatic tooling attachments for small products enable station spacing at 24 in. and rarely at 18 in. Nothing is gained by crowding on multiple-station machines. Trend in design of tooling attachments in the next five years will unquestionably be toward trying to keep all mechanism for the attachment within an 18-in.-wide rectangle.

The common requirements for tooling attachments will include built-in interlocks for feed back of signals (for failure to complete any function), and complete automatic cycle functions to carry out repeating cycles as actuated by the master control. The attachments should be designed to mount on top deck, side locations or underneath locations on machines. Important dimensions should be more or less standardized for given capacities. All attachments must be capable of making complete cycles within the operation time limit of the transfer machine. Finally, all attachments should be wired to actuate on split-second sequence timing control that has long operating life.

Presently, designers are aiming at replacement of control components at 20,000,000 cycles. At 60 cycles per min, the transfer machine totals about 25,000 cycles per shift or 6,000,000 cycles per yr, and on two shift-operation these numbers are doubled. Therefore, on two-shift operation it will be practical to replace control components once a year to avoid failures leading to down-time losses.

### PICK-OFF ATTACHMENTS

Pick-off attachments can be applied to remove pallets to a conveyor "processing line" and to return the pallets to the machine after processing. The "off machine" operations might be curing, dipping, soldering, filling, soaking, etc, that take more time

than permitted by the cycle of the sequence-machining unit. However, the machines must be built for heavy-duty service to withstand hammer blows on the one hand and yet retain accuracy for automatic measurement of features held to ±0.0001 in.

#### PICK-UP ATTACHMENTS

Some jobs call for automatically picking the partial assembly from the pallet or work nest and placing it on a conveyor to an off-line operation. A parallel conveyor will bring the assembly back to the next station.

Normally, two pick-up tooling attachments are used at adjacent stations to unload and load the machine to and from the conveyors. These attachments function at exactly the same rate as the assembly machine, so that its work nests or pallets remain full. Proper automatic controls and interlocks tie the off-line process conveyor in with the transfer machine readily as for any other station tooling problem.

#### TRANSFER FROM STATION TO STATION

Transfer in the in-line type of machine requires sequential movement of the work nests or pallets from station to station in a closed path.

Transfer must be fast, yet with smooth acceleration and deceleration, so that workpieces are not tipped over or knocked out of position. Longlife operation is essential because work nest or pallet travel may be 2 miles per shift at 60 transfers per min on a 6-in. transfer.

If a vertical or side-mounted work nest or pallet is used, the overhung construction is supported on one side. This construction necessitates an additional support to prevent sag and deflection under working pressure.

#### INDEX AND WORK CYCLES

Time spent for indexing or transfer is non-productive. The best operating performance is realized from the machine that completes the index or transfer cycle in the least possible time. If we have a production rate of 60 pc per min it is necessary to index or transfer in ½ sec to have the remaining ½ sec for work. This is only 50% total productive time. Actually, a ¼-sec index has been achieved, attaining 75% productive time.

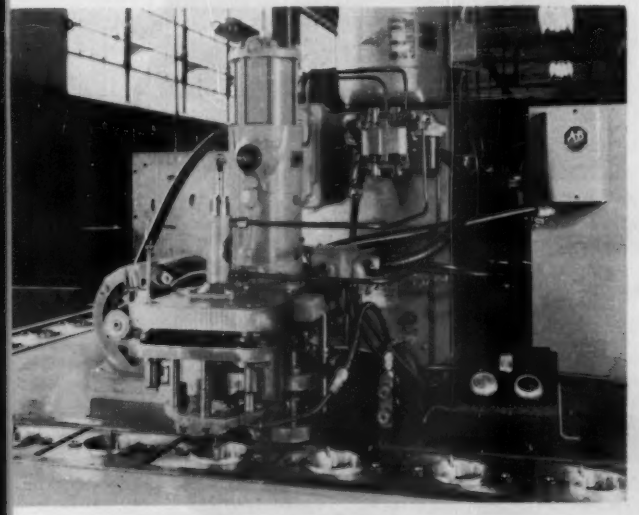
What happens with a slower rate of production, say at 20 pc per min? Let the transfer time remain at ¼ sec. The balance of the cycle is now 2¾ sec. We now have 11 units of work time for 1 unit of transfer time or 92% productive time.

The index or transfer mechanism can be an independent self-contained unit but suitable for incorporation in modular construction of the machine. This self-contained transfer unit should be available in several types to meet preferences of customers: mechanical, pneumatic, electric, and hydraulic.

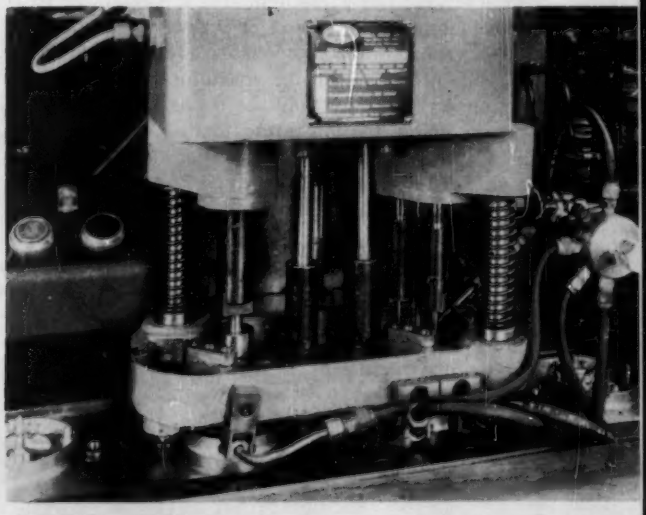
#### MACHINE OPERATING CONTROLS

Because the objective of in-line machines is to reduce labor they must be provided with controls so that one operator, and sometimes with one helper, can practically operate the machine through all phases of the daily production routine, including tooling changeovers, etc.

Control over the rate of production of all tooling attachments should be subject to the master electrical control unit, which has timing control to keep



**Accurate Location . . .**
Tooling attachment is on vertical slide, and accurate location is attained by three means: (1) pallets move in gibs, (2) work is located in pallet nest by two pins, and (3) the milling-head travel is aligned by guide pins, as used in die-set construction. Slotting or end milling can be done in such a setup



**Two Pallets at Once . . .**
A 2-station tapping head operates on workpieces in two adjacent pallets. Both pallets are free floating, but are centered under the taps by pilots. A common signal light and control governs the operation of the tooling attachment at these two stations. Tapping in this manner enables handling holes at close center distances

## WHAT'S HOLDING BACK THE AUTOMATIC ASSEMBLY MACHINE? . .

all circuits in exact timed sequence, regardless of the speed selected on the dial by the operator.

The basic requirement in an operating cycle is to get the fastest index or transfer time under all conditions, regardless of the work cycle time, which will vary with the job.

The indexing function can and should be entirely separate from that of cycling the attachments. The master operating control should trigger the index mechanism which should then be on its own to complete its cycle and stop until triggered again for the next cycle. When this basic principle is observed it is possible to have variable-speed work cycle controls to suit operation time at the tooling stations.

With this kind of setup, each basic function has the simplest control and each has full flexibility without any wiring changes on the machine.

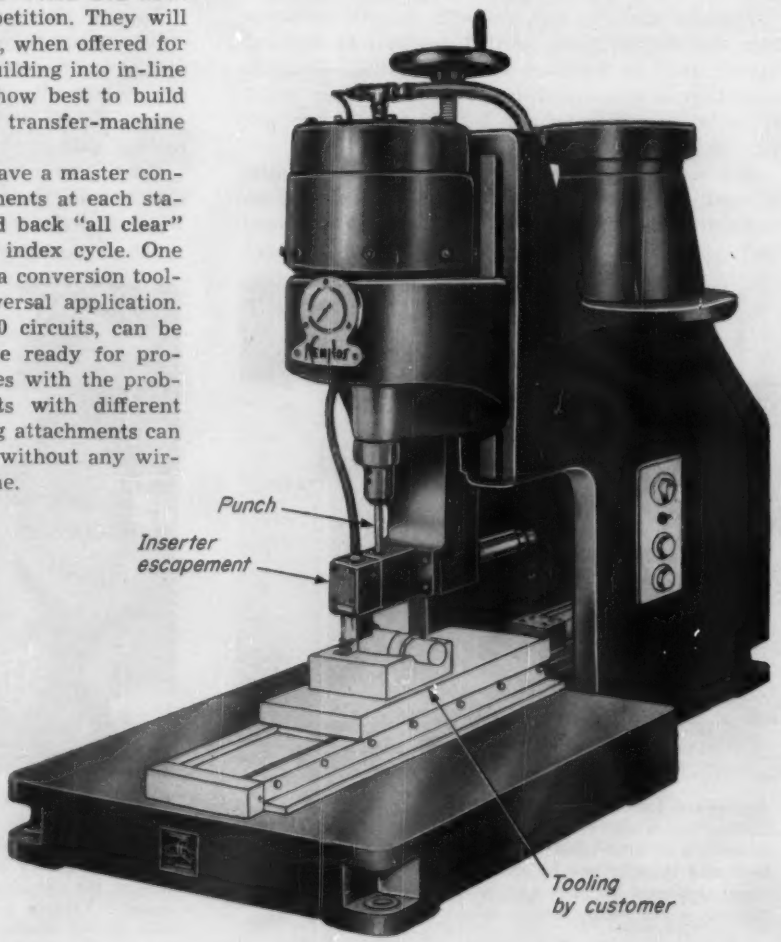
### TOOLING-ATTACHMENT CONTROL

Tooling attachments should eventually be available in 200 to 250 types. They will be manufactured by many vendors throughout the world and have distinctive features to meet competition. They will vary in respect to wiring methods, when offered for use as portable machines or for building into in-line machines. The problem will be how best to build the attachments into a proposed transfer-machine design without rebuilding them.

Each transfer machine should have a master control to trigger the tooling attachments at each station plus proper interlocks to feed back "all clear" or "stop" signals before the next index cycle. One manufacturer has made available a conversion tooling-attachment panel box of universal application. The device, which incorporates 20 circuits, can be plugged into the transfer machine ready for production service. This solution copes with the problem of using tooling attachments with different wiring arrangements. Thus, tooling attachments can be exchanged, regardless of type, without any wiring change on the transfer machine.

Dial and in-line transfer machines will have from 300 to 500 electric circuits for the machine and all tooling attachments. Such a large number of circuits can be almost fatal to efficiency unless basically established on a practical system of controls and interlocks.

Subway-train door interlocks offer an excellent model. The doors show red lights, the length of the train, when all doors are open, and any door that does not close still shows a red light. The train cannot start until all doors show green lights. One manufacturer uses this system as a positive and instantaneous method of locating trouble. Tooling attachments have a panel box at each station, and the lights are plainly visible to the operator at the control position. The machine and tooling are so wired that if any attachment does not signal "all clear" within its limited operating time the light shows red, and interlocks prevent the next index cycle from starting. The red light shows the operator instantly exactly where the trouble is located. This




**Designed Attachment . . .**
Many tooling attachments for assembly or machining purposes are adaptations of existing devices. Here is a Kenhos automatic "Rollpin" inserter, which has been specially developed for the table spacing and controls required on high-production machines. Device may be typical of scores of other attachments, in time. Production rate, 1200 to 1800 pc/hr

**Swing-Type Feeding Attachment . . .**
Fragile parts that must be picked out of pockets in trays or a pallet or work nest are handled one at a time. The device can have a pneumatic or magnetic shoe

system has been of enormous assistance in reducing downtime on 20- to 30-station machines.

#### CLEANING AND CHIP REMOVAL

The transfer machine for automatic sequence machining requires many built-in functions not included or required for automatic assembly services. Chip-removal equipment and coolant recirculation and filtration systems are examples. But note: the many kinds of chips created in different machining operations on different metals create severe problems. Special care must be applied to remove chips and coolant from the machines.

#### SUPPORTING SERVICES

Multiple-station machines produce such large quantities of assemblies and parts that careful planning is essential to prevent excessive downtime, because of parts shortages. If 10 to 30 different parts are required for a production run of 20,000 to 100,000 assemblies, careful time-scheduled handling is essential. Likewise, detailed scheduling is needed for removal of the assemblies from the machine, to the stock room or the shipping departments.

Included in this planning should be assurance that all parts coming to the assembly machine have been passed by inspection for quality dimensional control. Otherwise, there will be trouble at the automatic assembly machine. Experience has proved many times that 75 to 95% of downtime on assembly machines can be traced to off-tolerance parts.

Also, provide ample work-in-process stocks to cover later operations, so that downtime of the round turntable or transfer machine will not stop subsequent operations.

#### RATE OF PRODUCTION AND BALANCING OPERATIONS

When making an application-study for an in-line machine, establish the preferred sequence of operations in sufficient detail. Carefully balance time increments suitable for each station operation. It is desirable to work out a time chart for every operation, including the index or transfer cycle and the production dwell cycle. Thus, the time for actuating electrical relays and motions will be fully included. This chart will enable study of the comparative and relative elements of time for all necessary notions, clearances, delays and safety factors.

If certain operations seem to take too long for a balanced series of operations, consider dividing the work over two or three stations. Examples: deep-hole drilling and placing several screws or rivets. Always avoid having "too much" taking place at any one station, because complication risks excessive downtime.

Avoid tools that work on the opposite side of a part and travel clear across it to do the cutting job. Idle travel and return time can be greater than the allowed time per station. The solution is to change the sequence of operations to place this station with the work at the near side, not the far side, for shorter tool travel.

This study must include time for actuation of feed escapements and positioning devices, and for retraction of tools to clear the pallets. Time values should be entered for pickup and turnover operations and for those involving two motions per station, such as one motion to hold the work, while the other feeds and performs the operation, and both retract.

Actual time studies should be performed before

decisions are reached about a time balance. Often hand operations should be placed in the line, as a practical solution when automatic tooling would be too complicated or costly.

The practical rate of production will range between 20 and 60 cycles per min. There is little to be gained by operating above 60 cycles per min, because many factors become critical to affect downtime.

#### AUTOMATIC OR HAND FEEDING

Another problem in developing an operation sequence for both automatic assembly or for automatic sequence machining is to determine whether initial loading and unloading, or other operations, should be done by automatic attachment or by hand.

Where hand operations are involved, consider first the fatigue factor vs the practical rate of production. If parts are large or heavy, relative to machine capacity, it may be best to feed by hand from tote boxes or bins. Again, parts may be of a shape such that it is next to impossible to feed them by known mechanical means, or they will not automatically orient themselves or track to the machine. A sub-assembly or complicated part will be most difficult to handle automatically at satisfactory cost. Actually, such parts are rarely bulk handled. Many times they are placed in individual pockets in trays for single handling. They can be only handled automatically in a practical manner by the relatively expensive pick-up attachments with $x$-$y$ positioner tables to shove the tray of parts one pocket at a time.

All parts that can be stacked in magazines, for top or bottom delivery, will handle automatically as will all parts that can be bulk fed, oriented and tracked in automatic control. Many types of feeders are commercially available. But note this: not even skilled feeder engineers can guess correctly every time as to how a given part will feed with continuous uniformity. Test every part in a feeder for a particular part. This can be done quickly in sample test feeders.

#### MULTIPLE UNITS

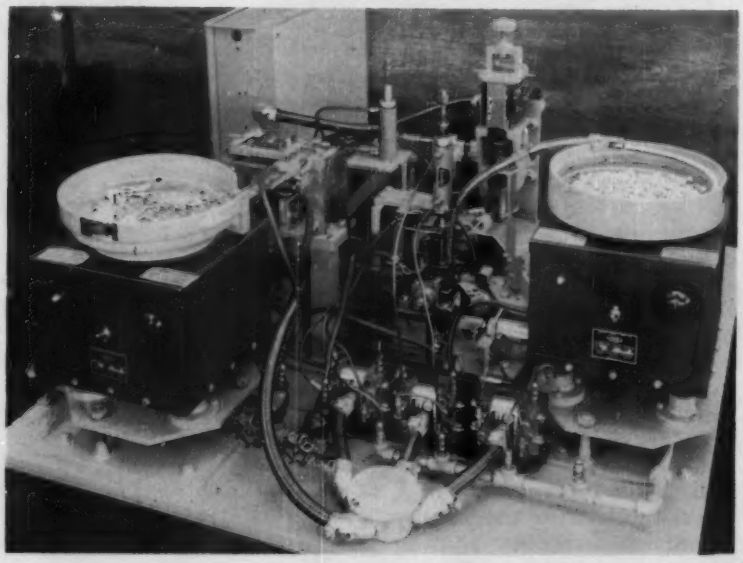
There is a growing interest by manufacturers in full automatic assembly in regular assembly-department production. These products consist of several mechanisms which are finally mounted together to make the complete product. Examples might be wattmeters, telephone receivers, pressure gages, thermostats, etc, that run to more than 200 parts.

Such products require a machine for each mechanism and one for final assembly. Often one or more semi-final assembly machines are needed too. When used with the proper work-in-process reservoirs, this system makes for practical assembly at lowest costs.

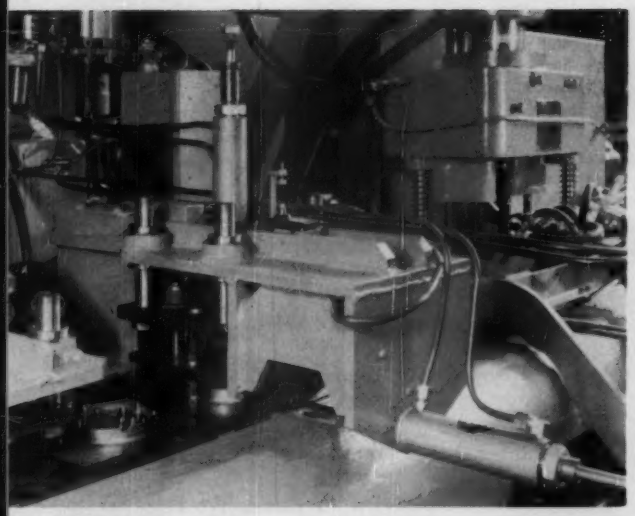
#### WORK-IN-PROCESS RESERVOIRS

For a multi-unit assembly department, flexibility is achieved by placing work-in-process reservoirs between machines. Thus, any downtime at one machine will not shut down the others. Also, if the production speed of machines can be varied, the machine that has been down can be speeded up slightly, when restarted, until reservoir volume is again in balance.

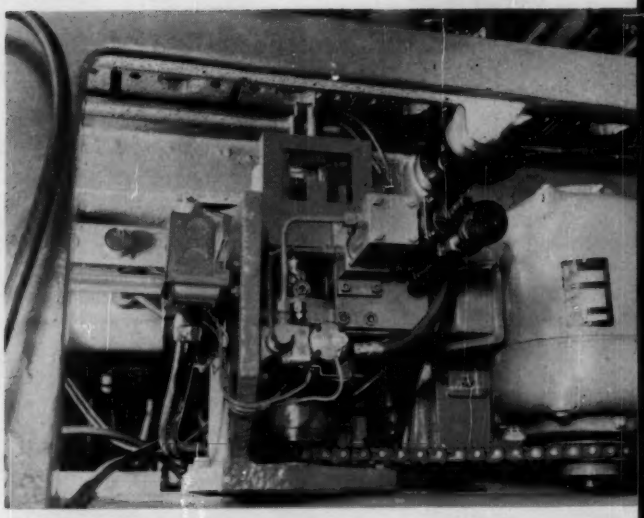
Work-in-process reservoirs may be of several types. Continuous storage-and-draw magazines are coming into use. Their capacity can be any amount desired. Other types fill magazines, which are manually or automatically removed to storage rooms. Overhead conveyor lines of any length are common.



**Special Assembly and Staking Machine . . .**
This is the way equipment must be put together, today, for lack of standardized tooling attachments in broad variety. A plate with 4 countersunk screw holes on one side must be oriented, a threaded member inserted in a central hole, and perfect flatness of the plate maintained despite staking



**Probe Unit . . .**
Parts must not progress through the machine with a broken drill or tap. Here the probe must go to the bottom of the hole or the machine will be stopped. In the case of an automatic assembly machine, the probe is used in the feeder track to detect pieces lacking in the required work nest



**Underneath Tooling . . .**
If the machine has sturdy locating surfaces, underneath tooling avoids a second-operation setup. Here 4 holes are being chamfered by an attachment under the pallets

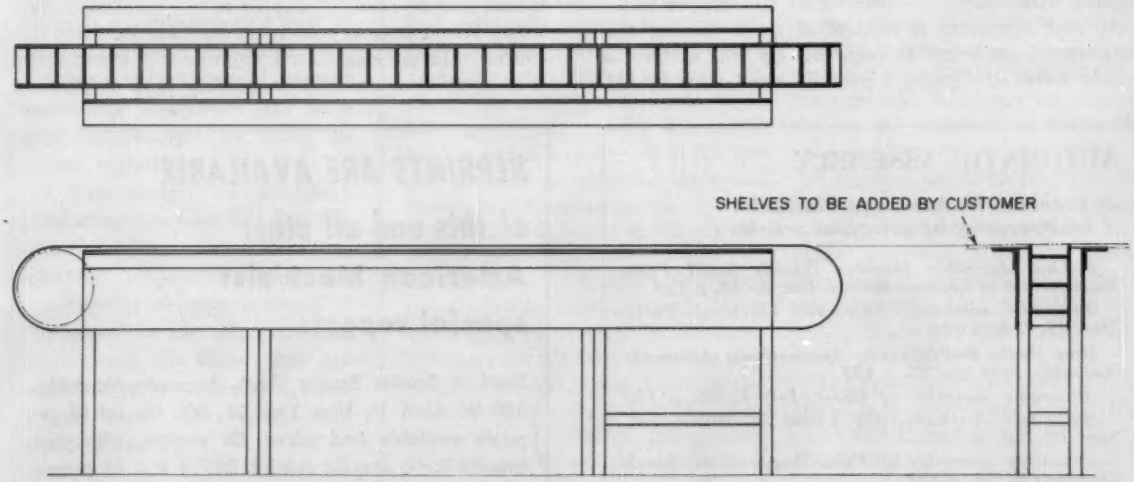
For bulk handling, any of the automatic bins, hoppers and feeders provide satisfactory flexibility.

#### SPECIAL MULTIPLE-STATION COMBINATIONS

There will always be jobs requiring 2 to 7 stations—too few for a dial or in-line machine but suitable for small index tables and pusher lines. This class of application can most suitably use automatic tooling attachments with automatic electrical controls to actuate each station in the proper production sequence. Careful study should be given to these special applications to produce standardization of frame height, operating clearances, accessibility, etc. Often this several-station table or frame will prove economical and efficient for sub-assembly operations along with the full automatic assembly machine.

#### LOW-COST APPLICATION

Short-run items are the headache of every assembly department. The amounts that can be allowed for tooling are far too small to pay for automatic tooling attachments. The solution lies in the use of "group assembly machines." This type of equipment is to all practical purposes "mechanized bench assembly," but under new design and skilled




**Stripped Down Assembly Machine . . .**
Endless chain drive carries pallets past tilted bottom parts bins and operators. Tooling attachments, shown elsewhere, should not be used, because chain stretch interferes with accurate registry. This is strictly a low-cost method for small volume where tooling cannot be supplied from the available budget

methods-time study techniques. The objectives are to time-balance each operation and restrict each operator to one operation that needs only hand and arm motion. The machine has a transfer or index to bring the work nests or pallets before each operator. The team, or group, of operators work together on this line with all parts placed before them, within ½-in. of the edge of the pallet in tilted-bottom bins. Increased productivity is always realized over bench assembly of the same product, where the operator hand motion is limited to not over 3 in.

This is also the most practical solution for highly complicated devices that are not suitable for automatic assembly. No tooling costs for tooling attachments are involved, except for a few parts bins, etc. Group assembly machines cost about one-sixth as much as full automatic machines.

#### PRODUCT DESIGN FOR MACHINE ASSEMBLY

There is an amazing lack of understanding of what is required in a product to make it suitable for low-cost manufacture and automatic assembly. This is the key: in childhood we had sets of telescoping blocks that would assemble one into another with a simple direct motion. Remember this: a simple, direct motion is the keystone to success in assembly operations. Almost all products can be designed with this principle in mind—without affecting their functioning in any way.

#### TOOLING FOR SIMILAR PRODUCTS

Duplication of tooling attachments can often be avoided by studying requirements for a series of similar products. The real difference may be in one or two parts. In such cases, the solution is to place the tooling attachments in proper sequence to feed and assemble specific parts to all sizes of the product. Where a different-sized part is used, another tooling attachment is mounted at the proper location, and operation is controlled by switching the attachment on or off as required. By this method a whole series of sizes of a product can be assembled without downtime for changeover to clean out parts and fill tooling attachments with other parts.

#### MACHINE DELIVERY TIME

Frequently those of us in the business of engineering and manufacture of transfer machines and tooling attachments are asked what is the most difficult problem encountered. Strange as it may seem, it is the lack of understanding by responsible officials of the proper time required to carry out all of the requirements to produce a successful production machine and tooling. The problem cannot be broken up, and still maintain engineering balance.

When all design layouts are complete, the customer's engineers are brought into conference for approval and authorization to freeze designs and finish detail drawings. Up to this point between 1,000 and 6,000 manhours of engineering work may have been involved. Manufacture, assembly, adjustment (debugging), and trial testing remain. The final perfection and acceptance test *date can never be predicted* even by experts with a lifetime of experience in this field. Automatic assembly machines can only be released for production use when they are pronounced ready by the builder and the operator and maintenance men sufficiently trained.

Through several years of experience, the automatic assembly machine has been brought to a high state of development. It is possible in the next few years that this kind of equipment will become broadly used in many industries. When we asked "What's Holding Back the Automatic Assembly Machine?" it was with the idea of focusing attention on some of the matters that need standardization, and the manner in which controls should be developed. When these matters are satisfactorily resolved and adopted, the way will be open for many suppliers to offer tooling attachments that will fit standardized spaces and be readily coupled to the machine's controls. When that day arrives, machine builders can concentrate on specialized engineering aspects and ship completed units more quickly than at present.


## AUTOMATIC ASSEMBLY

***as reported in* American Machinist**
***A bibliography of principal articles***

*In-Line Assembly Machine Speeds Small Parts Manufacture at General Motors. Dec 7, '53, p 121*
*Automatic Assembly of Complex Electronic Parts, Mar. 15, '54, p 186*
*How Radio Builders Are Approaching Automatic Assembly, Sept 26, '55, p 132*
*Automatic Assembly of Slider, July 4, '55, p 132*
*Automatic Assembly, the Latest in Automation, Sept 10, '56, p 129*
*Automatic Assembly of Valve Cages at AC Spark Plug, Oct 8, '56, p 121*
*AC Spark Plug Machines Assemble Spark Plugs, Nov 5, '56, p 145*

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**Fig. 1—Older Method.** Manual indexing of a hand-operated space comparator is slow, but the method is versatile in that the indicator head can be adjusted to compare the base pitch of all gears and the normal pitch of helical gears as well

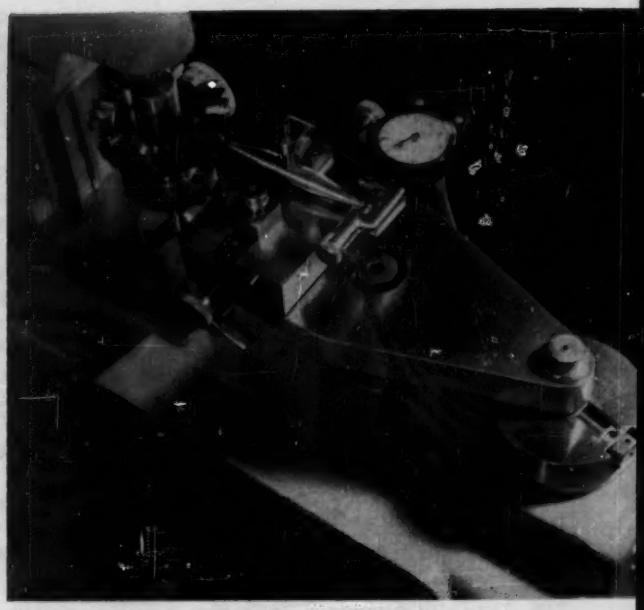


**Fig. 2—Newer Method.** An automatic space checker cannot distort very small increments in space variations, hence is more accurate and faster than the hand-operated checker. Here the device is shown being used to check the tooth spacing of a gear-shaper cutter

**New Automatic Instrument to . . .**

# Space-check your gears

FRED BOHLE, manager, Machine & Gear Development Dept, ILLINOIS TOOL WORKS, CHICAGO

**Space checking of spur and helical gears is an indispensable part of process control in connection with:**

**1. Indexing accuracy of primary generating equipment like hobbers and shapers, to avoid involute variations**

**2. Tool control for secondary generating processes like shaving, Gerac finishing, and generating-grinding**

**3. Control of spacing errors of "form-cut" or partially generated gears, such as those that are milled or form-shaped, and those ground from index plates and master gears**

Accuracy is a byword for all gears that must transmit power quietly and efficiently over a long period. Even if little power is transmitted, gears should preferably not be heard. At shaft speeds upwards of 300 rpm, gear noises are much within audible range; even the input gear of an electric clock can make an annoying sound.

Most parallel-axis gears are involute gears of either the spur or helical type. If high-performance requirements must be met, these gears must be checked for involute, lead and parallelism. They are also checked for size, runout and tooth-to-tooth errors on gear rolling fixtures. But in practice, the spacing of gear teeth, which is of equal importance to involute, lead and parallelism, is often neglected.

Space checking was once a sensitive, difficult and time-consuming operation. The check was a hand operation, in which it was necessary to index from tooth to tooth, read a dial indicator and jot down the readings. Readings were sensitive to the pressure by which the operator brought a gear tooth to rest against the fixed finger of the checking device, Fig. 1. Modern recording methods, however, have made possible automatic space checking of all teeth of tools or sample gears, in no more time than the involute or lead check of one tooth, Fig. 2.

The result of the automatic space check is a space chart, Fig. 3. Unlike dial-indicator readings, the space chart gives a quick picture of the *uniformity of the gear teeth as reflected in space variations* at any diameter between the OD and

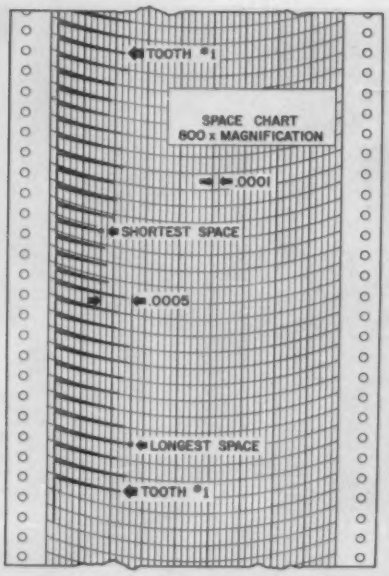



**Fig. 3—Typical chart** produced by the automatic tooth-space comparator with recording attachment. Large magnification permits readings to 0.0001 in. easily

root. But many gear engineers do not know what to do with the space check after they have it. In generated gears, spacing is not a well-defined issue like involute and lead accuracy.

About the only people who appreciate the importance of tooth spacing are those who produce splines or gear sets of high indexing accuracy. They know about tooth-to-tooth spacing, accumulated or index errors, 180° variations as a result of runout, and total index errors. People who produce gears for transmitting power quietly, which includes most gear producers, are not concerned with indexing errors of, say 0.0005 in. in 60° of rotation, when they have involute errors of 0.0002 in. in 5° of rotation.

Parallel-axis involute gears transmit motion along the line of action. The distance between successive involutes along the line of action is called the base pitch (See Fig. 4). Proper spacing is meant to be that distance along the pitch line which results in correct base pitch, so that teeth can go in and out of action without clashing. However, involute errors can separate gear teeth just as readily as space errors can. Involute errors, as well as space errors, cause sudden accelerations, decelerations, clashing and noise. The difference between involute and space errors is merely one of frequency. Many more involute errors can occur per second than space errors.

In gear production, about the only time that space variations can occur, distinctly apart from involute errors, is when the gears are milled, form-shaped or ground from index plates or master gears. As a class, these are gears which are form-cut or only partially generated. In these cases, which incidentally include all shaper cutters, it is absolutely correct to separate involute and spacing errors, and assign separate tolerances. All these gears or tools should be space checked as one measure of their quality.

The situation is completely changed if the gear is fully generated by, say, a single-thread hob. A hob of correct lead and pressure angle, that is, of correct and constant base pitch, cannot make a base pitch error. (See Fig 5). Therefore, if the hobbing machine produces an incorrect indexing motion, it must result in involute errors. The base pitch, as produced by the tool, is constant. The same applies to other gear-cutting processes like shaping, shaving, Gerac finishing and Reishauer grinding. In fully generated gears, spacing and involutes are inextricably interwoven. However, although an involute check of all gear teeth might show a confusing variation, a space check, especially an accumulated space check, might show the source of the errors.

Illinois Tool Works has for years made a space checker which can be adjusted to compare base pitch. As previously mentioned, base pitch appears to be of major importance as gear teeth go in-and-out of action along the line of action. But because most gears are generated, that check merely served to check quality of the tools. Therefore, that feature never acquired any degree of popularity, and rightfully so, because the tools could have been checked separately and not through gears they produced.

The lead of hobs and the thread spacing of multiple-thread hobs is checked on the Illinois hob and worm lead checker. The results should be recorded to determine the effect of the tool on gear-tooth spacing.

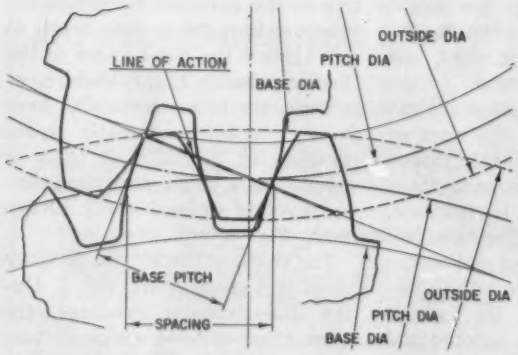



**Fig. 4—Correct tooth spacing** is essential for teeth to go into and out of mesh without clashing. To achieve this condition the base pitch must be correct

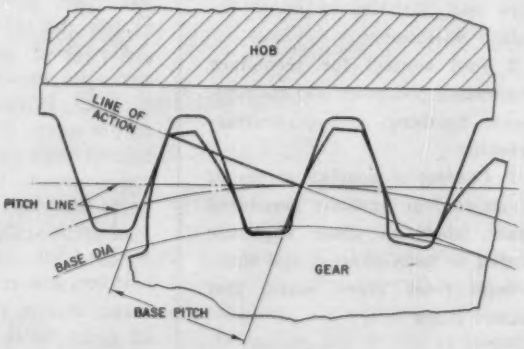



**Fig. 5—Base pitch** of a hob

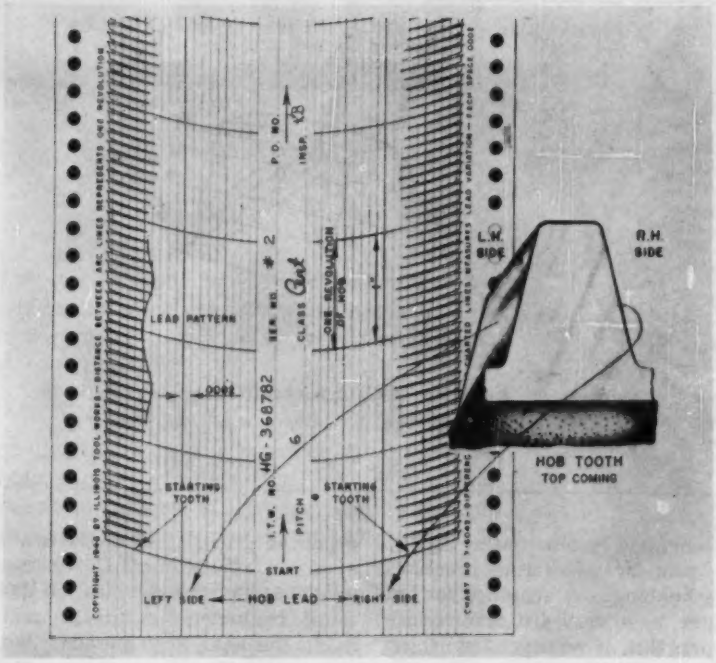



**Fig. 6—Tool-graph chart** of a single-thread hob shows that variation in lead per revolution amounts to about 0.0002 in.

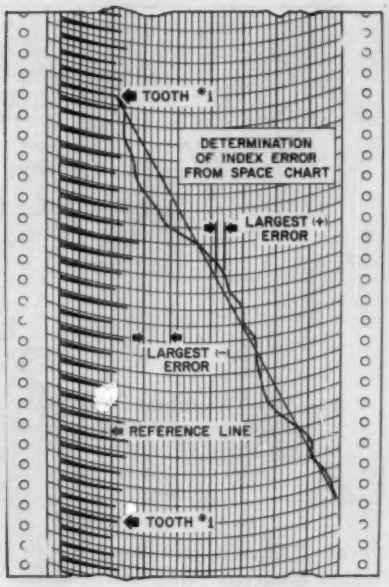



**Fig. 7—A space chart** can be used to illustrate the indexing errors of a gear. The wavy line is obtained by adding or subtracting the deviation of an individual tooth from the reference line to the value for the preceding tooth, and connecting the ends of the wavy line. Index errors are measured from the straight line

Shaper cutters, Gerac cutters and shaving tools are checked on the Illinois automatic space checker. The quality of gears is never better than that of the tools which produced them. (See Fig 2).

Arriving at the index errors or the accumulated error, as it was once called, is a very easy matter from the space chart. All one has to do is to pick a reference line and add or subtract the distance or value of the individual tooth to or from the preceding value. (See Fig 7). After all teeth have been processed that way, the beginning of the charted line is connected to the end by a straight line. The index errors are measured from that straight line.

The Illinois recorder is equipped with a magnification of 800 times, so that the individual space variations, though small by themselves, show up as appreciable distances. Thus 0.0001 in. becomes 0.080 in. on the space chart.

It is by no means suggested that index-error checking be performed on every gear or as a part of 100% inspection unless the gears are used as index gears. As a rule, this kind of work is done to check the basic accuracy of generating machines. People who have made a study of gear noise report that when the total sound is analyzed by its various frequencies, these frequencies are found to be multiples of the number of teeth of the cutter, the index gears and all the change gears.

Aside from distinct space errors or index error-induced involute variations, hobs and shaper cutters leave their own imprint upon the gears they produce. Hobs famously reproduce their own

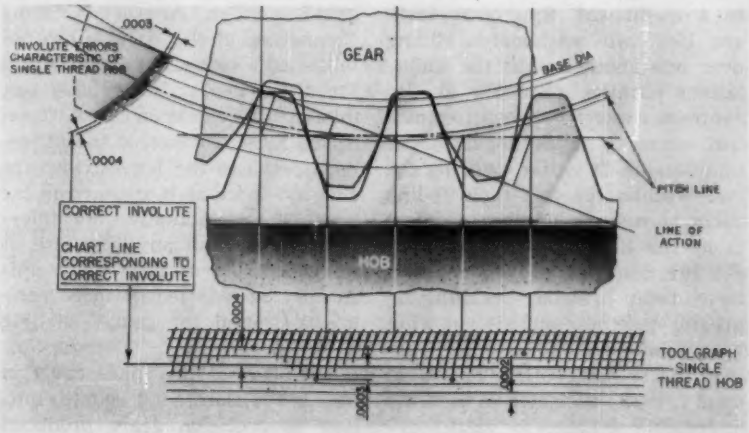



**Fig. 8—Variations in lead** of a single-thread hob reproduce themselves as "weave" or variations in the involute profile

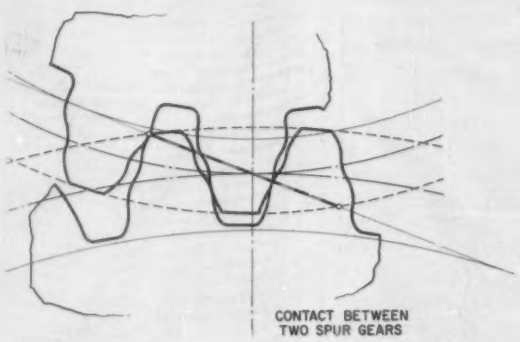



**Fig. 9—"Washboard" contact** of spur-gear teeth occurs (shown exaggerated) as the result of variations from the involute, typical of hobbed gears

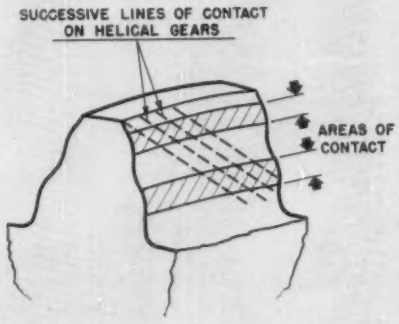



**Fig. 10—Contact conditions** existing in a helical gear

'weave,' that is, the lead errors which occur in every convolution of hob teeth. (See Fig 8). Shaper cutters reproduce their own spacing errors, particularly the accumulated ones which appear at the place where the end of the finishing cycle meets the beginning.

The quest for greater gear accuracy is never-ending. After all has been done to provide better machines, tools and additional finishing processes, design can help by specifying helical gears rather than spur gears for greater quietness.

Generating processes produce the tool-induced and index-induced involute errors in the transverse plane and they repeat themselves throughout the width of the gear. On a magnified scale, the involute surface of both a spur and a helical gear may be compared to a washboard. Spur-gear teeth are like two washboards sliding over one another with the undulations parallel. (See Fig 9). By contrast, contact between two helical gears is at an angle to the undulations. It is like twisting the two washboards and then sliding them across one another. Contact is at the high ridges only. (See Fig 10). Some of the surface errors have been bridged, resulting in greater quietness but also in what gear people refer to as 'split bearing.' After everything has been done to make the gears as accurate as possible, to object to "split bearing" is like "biting the hand that feeds."

Generated gears, gears cut by the primary generating processes like hobbing and shaping, can, of course, have very distinct involute errors. But, if additional finishing processes are used—one of the secondary generating processes like shaving, Gerac finishing, or generating-grinding — the involutes are usually very good and uniform. Because, in generated gears, good involutes cannot co-exist with bad spacing, it is universally found that such gears have excellent spacing. In such cases an involute and lead check carried out on one tooth, plus a space check, tells the complete quality story of the entire gear.

Some gears, like aircraft gears, must be made to a high degree of accuracy. Many of these gears are ground today on generating-type grinders. The Aircraft Gearing Committee of the AGMA has established a special set of tolerances for these gears. They have one tolerance specification called "Total Space Error," which is the difference between the longest and the shortest space as it appears on the space chart. Actually, the tolerance, more than anything else, is an expression of gear tooth uniformity *as reflected in space variations* around the gear. (See Fig 11).

Such use of the space chart in final inspection is, of course, limited to precision gears produced in relatively small quantities. For passing upon the quality of mass-produced gears, other methods are available. These methods do not give the same insight into the detailed characteristics of the gear as do the analytical methods, but they are reliable so far as the specific gear is concerned and are many times faster. By and large, space checking, like involute and lead checking, is used primarily in the day-to-day control of the manufacturing processes.

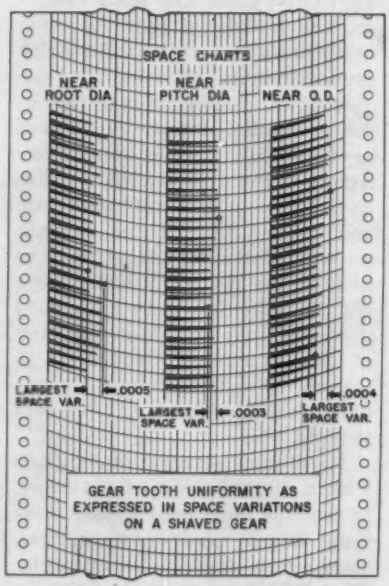



**Fig. 11—Secondary generating processes** tend to improve tooth spacing, particularly at the pitch diameter of the gear. These charts show the uniformity of spacing secured by shaving

# Round Table...

# *Hold Back the Pay*

"I'm going to recommend to Harrison that we hold back a week's pay from the men, Al. Maybe we can cut down on some of this quitting without notice."

"Why, that's illegal, Ed. You can't do it."

"No, it's not, Al. As a matter of fact, it's an old idea that a lot of companies have practiced —more in the old days than now. It's a good way to make sure a new man doesn't run off owing the company money for tools we've advanced him."

"It doesn't seem right to me, Ed. That means a man would have to work here at least two weeks before he got any paycheck at all, and then it would only be for a week's work."

"Right! Another good thing it does is give us time to check on his work, if he's just been hired, to see if he can turn out satisfactory stuff before he can take off like a bird."

"Ed; it just seems like a crummy deal to me. I'll admit it may help the company keep better control over employees; but it sounds like the dirtiest trick in the world."

"Listen, Al; even the government does it. Maybe you never heard of the idea, but it's well established. Once the man's settled down, he doesn't have a thing to worry about. Besides, he gets his week's pay when he leaves the company, so he's really not out anything."

"Even so, I'll bet the men would strike if you tried it now. You can't just take away a week's pay, Ed. Most of the men couldn't afford it."

"Well, maybe we can't do it to the men who are already working here, but we can do it with new men."

"Then as soon as the old-timers hear about it, they'll tip off the new boys, and you'll have trouble anyway."

"Maybe not, Al. It's like forcing the men to bank a week's pay; and it would be doing some of them a favor."

"Fat chance you'd have of convincing them. Savings accounts are fine, but you can't *force* a man to save."

"Well, I'll see what Harrison says. I think it's a smart idea and worth a try."

• • •

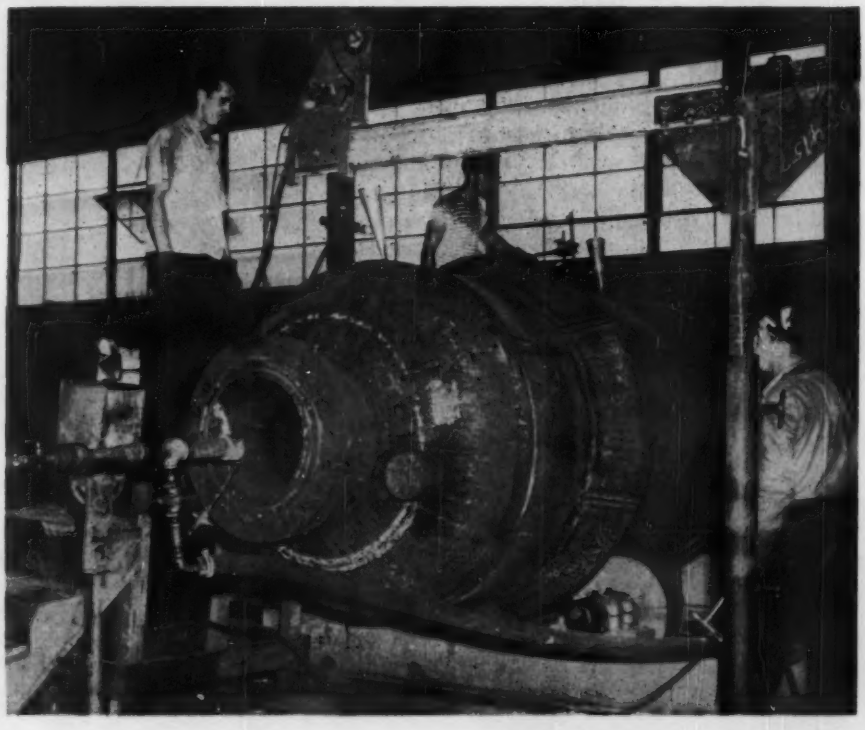
***SHOULD** a company hold back the pay for one pay period to combat fly-by-night operators, or is Al right in thinking it's a dirty trick? Your opinions may help others make decisions. Discussions of earlier topics start on page 220.*

**Two operators**
use simple setups for continuous girth welding with manual, semi-automatic Lincoln "squirt" welders

# The little "squirt" grows up

**You don't have to buy special equipment for special welding jobs; you can use what you have, plus some ingenuity**

PAUL GALAMBOS
welding engineer
and
FRED HERSEY
project engineer
O G KELLEY CO.
BOSTON, MASS



**Preheat** of heavy-wall stainless steel tank is performed with a 2-in. gas flame impinging on a stainless baffle

Welding heavy-wall stainless steel pressure vessels for use in oil refining posed some interesting problems for the O G Kelley Co. The material was chrome-moly A-301, Grade B steel, and four vessels were to be made with an ID of 54 in., a wall thickness of 2⅛ in., and lengths up to 13 ft 7 in. They were ASME 1952 code stamped, and welds were stress relieved and completely X-rayed.

It was decided to do the job by automatic welding, and the most satisfactory method appeared to be to use a mild-steel electrode wire with an agglomerated alloy flux whereby the alloy is added to the weld through the flux, rather than through the wire. A sample lot was obtained from Lincoln Electric, and analysis of test welds showed that it gave a deposit equal to the parent metal. A standard L 60 mild steel wire was used.

We had in our plant two manual semi-automatic Lincoln "squirt" welders, and it was decided that these would have to be adapted to render them full-automatic. To make sure they would work we ran three plates about 3 ft long at 20 ipm with 500 to 525 amp at 24 to 36 v. This showed we were on the right track, so we built temporary fixtures to mount the guns over the tank as it rotated on a power-driven positioner.

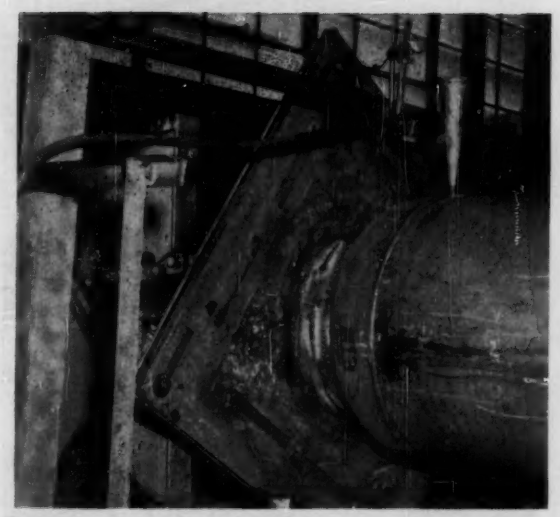
The vessels were to be preheated, and welding could be done from the outside only, as it would be extremely difficult to weld inside at a preheat temperature of 400 to 450 F. This simplified preheating, which we carried out with a 2-in. gas flame thrown against a stainless baffle and dispersed.

At this point we ran into an unexpected problem: how to obtain material for backup strips. To obtain these in Type 301 analysis would mean a considerable delay, and we would have to purchase considerably more material than we needed. Again the "squirt" welder came to the rescue. With the full cooperation of the inspectors, we made our own backup strips out of mild steel by milling a slot in flat barstock and filling the groove with weld metal of 301 analysis. In this way, we obtained our 301 backup strips without delay and at very low cost. They were, of course, removed after stress relieving.

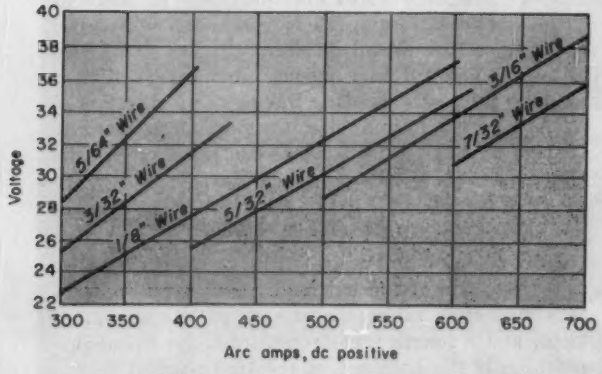
A single "V" butt joint with 20° included angle and ½-in. root opening was decided upon after consultation with the flux manufacturer. The latter gave us a procedure showing the exact control of analysis with changes in voltage and current, and the recommended current and voltage for the job. This procedure was followed closely, and drillings from the weld for analysis purposes showed the weld metal to be well within the range for 301 material.

We decided to weld with a large number of passes, angling the heads from side to side of the "V" on alternate passes to avoid locking the flux in the joint. As a result, the flux falls off of its own accord and it is not necessary to stop at any time for flux cleaning operations. When we started on the girth seams, the welding was done continuously, the only stops being for changing the 60-lb reels of wire.

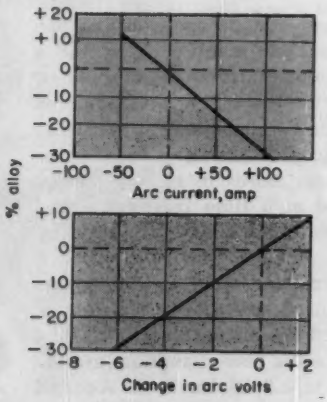
Two welders were operated simultaneously, and the work continued without stoppage, requiring, at times, three-shift operation. X-ray results were entirely satisfactory, and our home-made setup turned out a fine job of Lincolnwelding on a critical material.



**Power-operated positioner** rotates tank as multi-pass welds are made with mild-steel wire and alloy flux

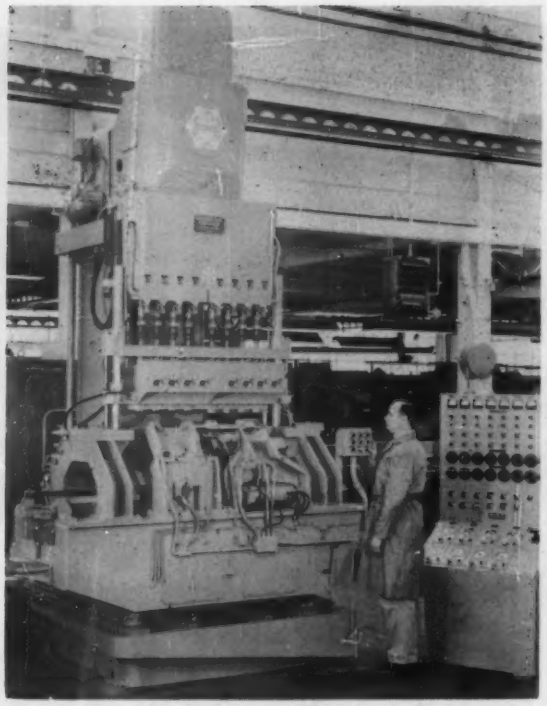



**Procedure guide** for welding. Smaller multiple passes result in better low-temperature impact values

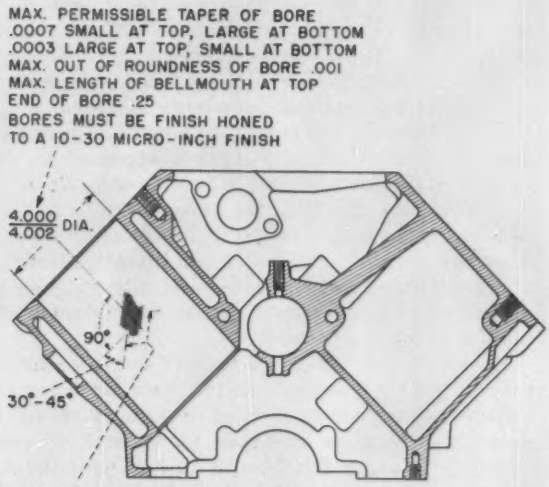



**Approximate change** in alloy content of weld deposit when arc current differs from that given in procedure guide

**Approximate change** in alloy content of weld deposit when arc voltage differs from that given in procedure guide



**Automatic size control . . .** in honing cylinder-block bores simplifies selective fitting with pistons for optimum engine-performance characteristics. Bore dias are held within 0.0002-in. total tolerance, but sizes for different blocks are spread over a range of 0.002 in. Hones can be set to produce blocks with bores at the high side, in the middle, or at the low side of this spread to suit needs dictated by piston production


MAX. PERMISSIBLE TAPER OF BORE
.0007 SMALL AT TOP, LARGE AT BOTTOM
.0003 LARGE AT TOP, SMALL AT BOTTOM
MAX. OUT OF ROUNDNESS OF BORE .001
MAX. LENGTH OF BELLMOUTH AT TOP END OF BORE .25
BORES MUST BE FINISH HONED TO A 10-30 MICRO-INCH FINISH
4.000
4.002 DIA.
90°
30°-45°
CROSSHATCH PATTERN TO BE GENERATED BY FINISH-HONE OPERATION
CROSSHATCH PATTERN UNIFORM BOTH DIRECTIONS (CLEAN CUT NOT SHARP)

BLOCK CYLINDER CROSS SECTIONS

# Automatic size control insures accuracy

**. . . in honing auto-engine cylinder bores. Not only can each bore in a cylinder block be honed to exact size, but individual bore sizes can be adjusted to meet any tolerance within a specific range to suit selective assembly with pistons**

Two cylinder-block lines are in operation at the plant of a leading automobile manufacturer, and a third is being installed to meet demands of increased engine production. One of the latest developments on the second line is a new finish-honing setup (see cover) where automatic "air sizing" controls the size of individual cylinder bores in engine blocks. Two blocks are handled at a time in this vertical "Hydrohoner," an 8-spindle, in-line unit built by Micromatic Hone Corp.

Before this finish-honing operation, cylinder bores are rough- and finish-bored and then rough-honed. Rough boring is handled by an automatic vertical Ingersoll machine, where the bore diameters are increased from 3.750 in. to 3.9425 in. Both Weddell and Ingersoll cutters are used here with carbide inserts. A second Ingersoll installation in the transfer line is employed for finish boring; here the cylinder bores are brought up to 3.9975 in. with Ingersoll "Cover-Lock" cutters containing 12 carbide inserts. Next step is rough-honing—in a Barnesdril machine that brings the bores within 0.0005 in. of minimum size—to leave as little as possible to clean up in finish honing.

In general, the bores are machined to leave as little stock for honing as is consistent with good honing practice. About 0.002 in. of stock is allowed on a diameter for this purpose, and every effort is made to prevent exceeding this by more than 0.0015 in. As a result, minimum and maximum amounts to remove by honing are 0.002 to 0.0035 in. on the diameter.

### AUTOMATIC HANDLING AND SIZE CONTROL

Four cylinder blocks are in the finish-honing area at a time: one at the exit end for transfer to a rotary inspection table, one in each of two work stations, and a fourth transferred from the Barnesdril machine to the entrance of the Hydrohoner.

Two hydraulic tables are employed in this setup,

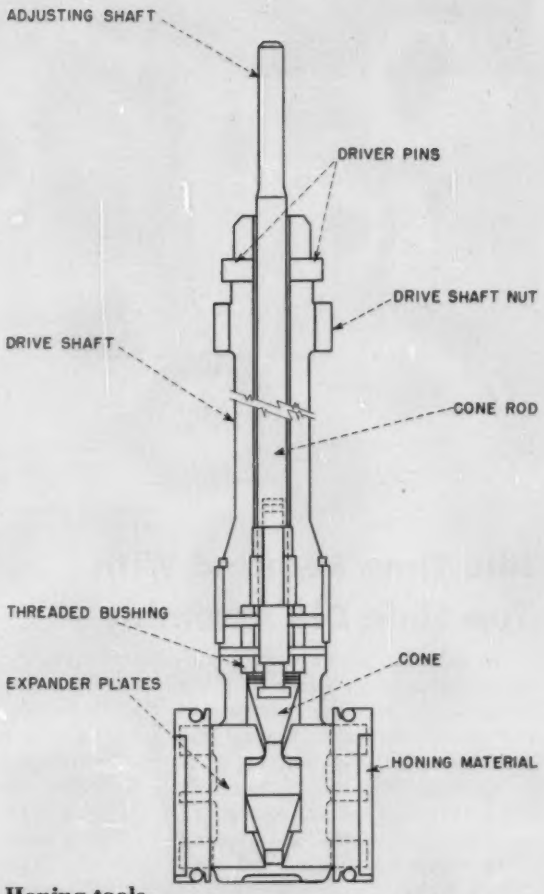
one under each set of four tools. At the first table, a block is tipped 45° from the pan-rail face to present a bank of four cylinders in alignment with the vertical hones. The table is locked in position until the bores are honed, then returns to receive a new block from the entrance while the honed block is indexed to the second station. Here the first block is tipped in the opposite direction for honing the other bank of bores.

Next transfer is to the exit, where the finish-honed block is removed manually and positioned on the rotary table over a light. Here the bores are checked visually for cutter marks, scratches, and other defects. At the same time, Sheffield air gages inspect the bores for size, taper, and out-of-round conditions.

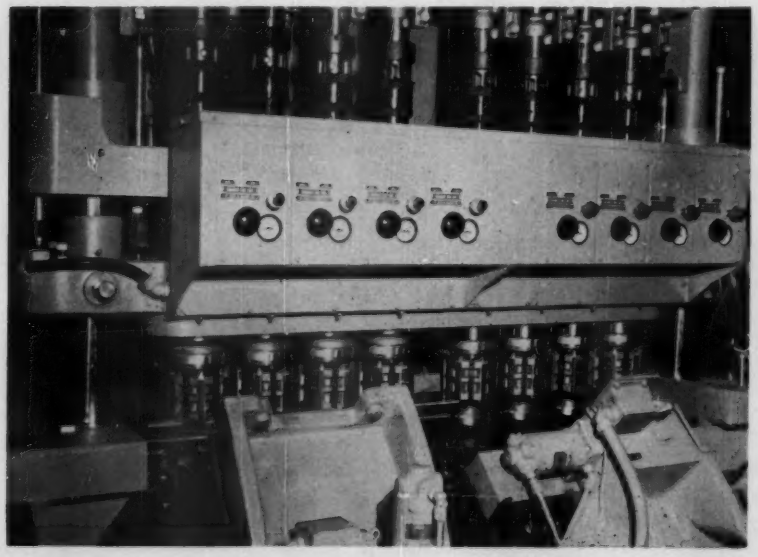
Size control in finish honing is established by air gages that reciprocate with each tool. These gages are preset to a given size and cannot enter the bore until it is within 0.001 in. of desired size. When they enter the bore, they actuate a gaging circuit which includes a dial that indicates bore size throughout the remainder of the cycle.

The operator can adjust the gages at any time without stopping the machine. When the bore reaches finished size, the gages automatically start a sequence of operations that includes collapsing the tools, withdrawing them from the block, indexing the next block into position, and starting the next cycle. With this system of "air sizing" each tool can be controlled individually, by dials at a console, to produce any required size.

Because bore sizes can be adjusted to any tolerance within a given range (0.002 in.), bores can be made to suit selected pistons for particular engines. Thus it is possible to use all the pistons machined in regular production regardless of variations, and the problem of matching pistons with cylinders for optimum engine performance is simplified.

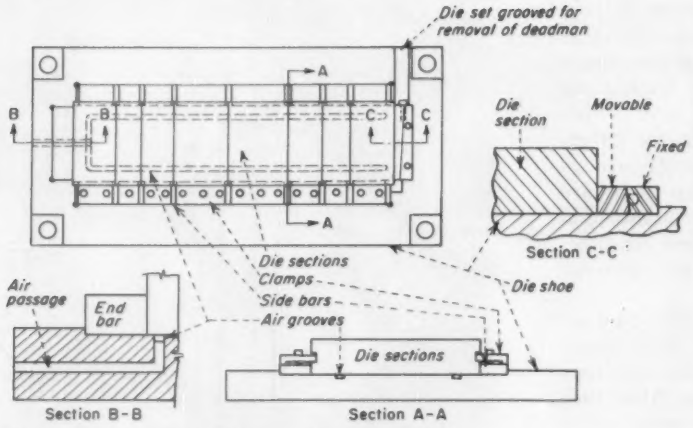



**Honing tools . . .**
are individually controlled by air gages to produce any size required. In addition, dc motors at each tool control expansion so that it is rapid during approach, after which "feed" rate automatically takes over on contact. When finished size is reached, tools collapse and withdraw



**Accuracy is consistent . . .**
with vertical honing tools, and more easily controlled. Action is straight up and down instead of on an angle, where the tools tend to deflect toward the lowest point. Cylinder blocks are tipped in opposite directions for honing one bank of four bores at the first station and the opposite bank at the second

# Practical Ideas




## Idle Time Reduced With Top-Slide Die Assembly

We turn out intricate high-production stampings almost entirely less than 0.060 in. thick. Instead of the usual practice of dowels and bolts holding the sections in place on the dies that produce them, we have devised a better method of assembly. This method is somewhat more expensive than normal construction, but the saving in idle time is considerable because the die set can be left on the press while repairs are done.

When the die is designed, we select those sections most likely to require attention and make them in duplicate, gang grinding them to assure uniformity. Each block is machined with a projecting step at the bottom, or a groove along the side, parallel to the bottom.

Along each side of the die is a hardened steel bar, recessed into the die set and secured with cap-screws and dowels. Each of the die sections is ground to fit snugly between these bars. At each end is a short bar to hold the sections together. One of these end bars is a two part wedge device. See sectional view C-C.

Two grooves are milled on the face of the die shoe, merging into an air inlet. These grooves are laid out so that they are completely covered when all sections are in place. The purpose of the air line is to help in disassembling the die.

If during a run a section shows signs of wear, or otherwise needs repair, the clamps holding that section are removed. The wedge bar is loosened, the section is lifted out, and a new one is set in. Should the section be unwilling to come loose, a couple of shots of air injected into the inlet will usually lift it.

*Richard Minser, Cleveland, Ohio*

### Machine-Cleaning Kink

A solution made by mixing household ammonia and turpentine in a 1:1 ratio makes an excellent cleaning agent for removing oil and grease stains from machines. This solution can be applied with soft cloth or cotton waste, and it works equally well on painted and machined surfaces. I have found it effective for periodic cleaning as well as cleaning for repainting.

*James C Dodge, Fort Collins, Colorado*

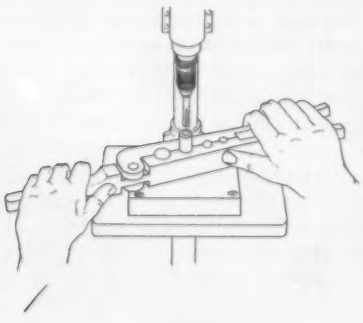
### Tool Cuts a Better Center Hole

We have seen the illustrated cutter do a better centering job than a conventional center drill in some instances. Even when the tailstock is somewhat out of line, this small tool acts as a boring tool and always puts the hole in dead center. It won't walk like a standard drill.

The tool is easily made from a piece of drill rod or drill blank about 3-in. long. The point is turned to an included angle of 60°, after which half of the point is ground or milled away as shown.

Incidentally, this technique will make a dandy countersink that can be used at high speeds without chattering.

*Howard Levy, Brooklyn, N.Y.*



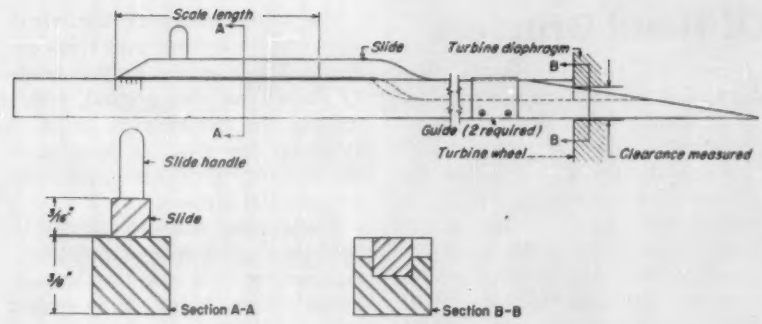
### Workholder is Fast Loading

To properly hold small parts for tapping in a tapping machine is difficult without the right fixtures. All fixtures add to the cost of the job, so naturally here's where you cut corners. We think we did just that when we made the illustrated two-handed holder for round parts of various diameters.

CRS bar stock was used in the construction of the holder. A hinge was machined to provide for fast loading and unloading. The extra hand grip extends from the hinge.

After the hinge has been fitted with a pin and the sharp corners rounded off, the workholding holes are machined. This is done with a shim held between the clamping bars. We used only round holes corresponding to our part dia, but they can be made hexagonal, square, or any shape desired.

*Charles H Willey, Penacook, NH*




## Taper Gages Check Turbines Faster

I have developed taper gages to take readings on wheel and diaphram clearances on turbines. Former method involved the use of gage blocks, feeler gages, and micrometers. As there are a considerable number of clearances to be checked, this method was tedious and slow, resulting in many errors.

These gages, though designed to suit our needs, are not limited to turbine work. They can be of great value to any similar type of operation. Some of their more outstanding features are: They are inexpensive to make, easily and quickly read, and can be used in fairly inaccessible places. They can also be used in pairs to check the clearance on opposite sides at once, as show in the photo below.

The bottom, or tapered, end does the actual gaging, while the upper end is provided with graduations, each representing 0.005 in. of space. This makes for easy checking in a comfortable position. Readings are taken without removing the gage, permitting two gages to be checked against each other simultaneously. Closer accuracy is thus assured, and the work time is cut to less than one third of the old method. No great skill is required to take accurate readings, and no more micrometers are dropped into the open turbine.

A typical gage is made of ⅜ in. square CRS 48 in. long, milled in the center to take a length of 3/16 in. key stock. This general design can be used for a variety of jobs, each gage calibrated to suit the readings required.

The tapered part of the gage is inserted between the wheel and the diaphragm until it stops. The 3/16 in. bar is then slipped down to contact the diaphragm. The reading is taken from the calibrations on the upper end of the ⅜ in. bar, with a beveled end on the 3/16 in. bar acting as pointer.

*A R Morrison, Southwestern Public Service Co, Amarillo, Texas*

### V-Blocks Provide Emergency Grinding Setup

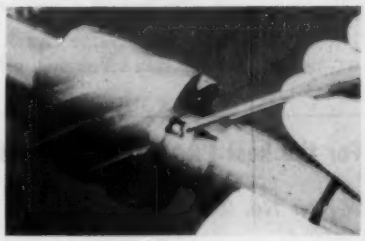
We set out to grind the main journals of a crankshaft which came from one of our engines. Customarily this would be done in the lathe even without a regular crankshaft grinder. This time we were stumped for a while because of the size of the shaft. It could not be swung in any of our lathes.

Now here was a challenge. We met it by going to work making two matched V-blocks which would cradle the shaft in two unworn sections. These blocks had to be high enough to provide clearance between the crank webs and the machine table. A grinding quill was made and mounted on a high-speed milling head. The quill was necessary to reach the journals between the webs.

The V-blocks were mounted on a large milling-machine table in such a way as to prevent longitudinal motion of the shaft in the blocks. A cup wheel was mounted on the quill and we were all set to start grinding.

The crankshaft was revolved by hand as the grinding wheel was fed to the work. Suitable power takeoff for revolving the shaft can be rigged from the milling-machine feeds if so desired. The table feed-screw provides the longitudinal feed necessary.

*M/Sgt. James R Wood, APO, NY*



### Steel Balls Assist in Removing Jammed Key

Every seasoned machinist has probably at one time or another had trouble in removing a jammed or sheared key. Whether the key is in a cutter, on an arbor, or on an ordinary shaft, it is usually necessary to force the key out from the inside end of the arbor. We use the illustrated method to remove such a key, and we like it so much that it has become standard procedure.

A few steel balls of a dia to fit loosely in the keyway are driven in one after the other by a punch and hammer. The balls will follow the key right on through the keyway as more balls are added and driven in. Once the key is out, it's no problem to get the balls out. They can be pushed out with a wire or even be blown out.

*H J Gerber, Stillwater, Okla*

# Practical Ideas

## The Use and Abuse Of Hand Grinders

In many of the places I have have worked, the hand grinder is a misused and abused tool. It is often looked upon as only a tool to knock off burrs or to grind off high spots on rough castings. Actually, with the many wheels, burrs, brushes, and attachments available, it is really a precision tool, particularly to the instrument maker and the tool and die maker.

Certain basic care and safety rules should be followed when using a hand grinder. Here are some suggestions:

- Always wear safety glasses or eye shields when using grinder.
- Never use a larger wheel than recommended.
- Never use a wheel or burr with a bent shank or bad runout. This is not only dangerous, but will also ruin the bearings.
- Always use proper-size chuck wrenches. Wrong size wrenches or pliers will ruin the chuck sides.
- Make sure there is enough of the shank held in the chuck. Stretching the shank by merely holding the tip of it is dangerous.

Grinding wheels should be selected with the same care as any other grinder. Any old wheels in the box may not be the best for the job. Finishes and cuts can be varied greatly if a selection of grits and bonds is on hand, and if the recommendations of the wheel manufacturers are followed.

When hand fitting punches and dies, high spots can easily and accurately be removed by the following method: After the proper wheel is selected it should be dressed to a slight barrel shape, taking care to keep the entire periphery running true. Light diagonal strokes are used, with the direction changed after each pass to crisscross the grinding pattern.

The barrel shape of the wheel allows better control over stock removal. The crisscross pattern readily shows the area ground, which reduces the tendency to grind or dwell on one spot too long, as is the danger with back-and-forth longitudinal strokes.

The grinder can successfully be used in a lathe with a simple attachment to hold it in the toolpost. Small internal holes can be ground with ease. Slots and odd shapes can be precision ground by rigging the hand grinder to a surface grinder, using the machine feeds to manipulate it.

Clamping the grinder to a bench, or gripping it in a vise, makes it a high speed buffer and polisher for fine parts. Adapted to a drillpress, it becomes a high speed drill for small number-drills. With the many burrs available, work on plastics and die cavities is simplified.

*H G Nicoll, Somerville, Mass*

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- **H J Gerber,** Stillwater, Oklahoma **'Oversize Holes With Standard Reamer'**

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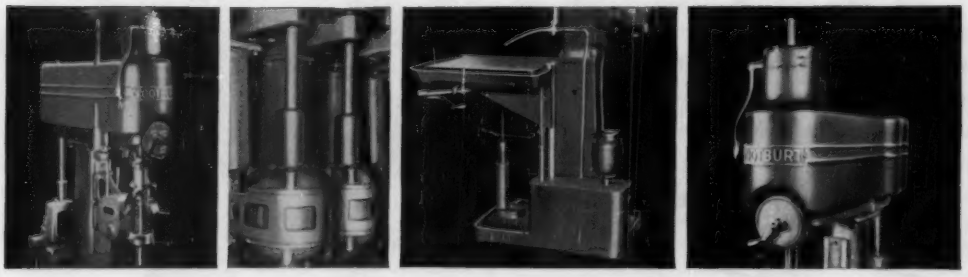

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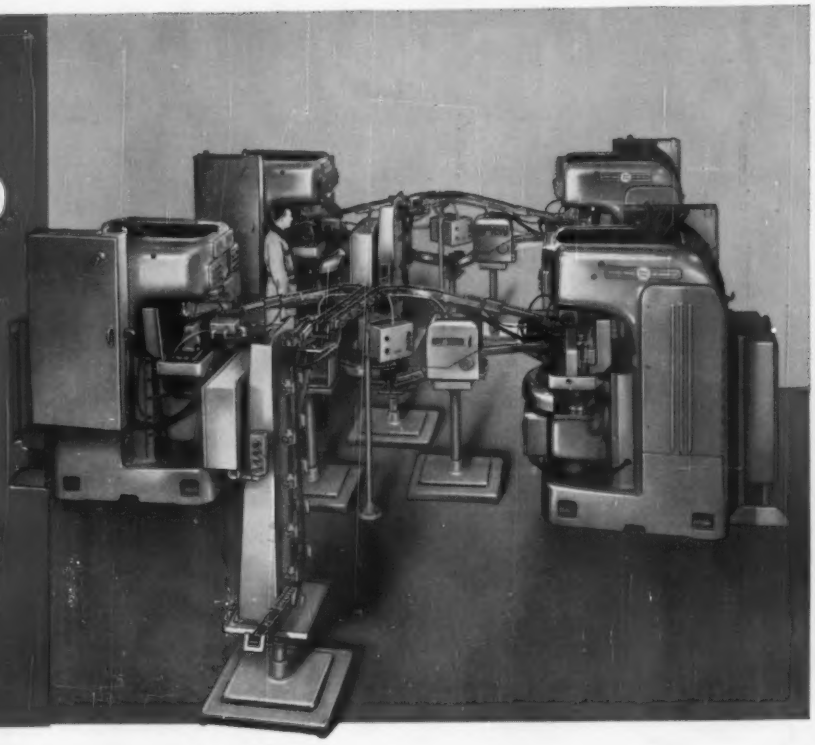

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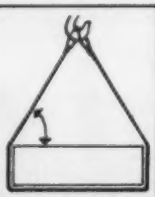
# "Safe" Loads for Slings..IV

**Refer to previous installment (AM—April 22 '57 p 163) and to the article "Safe Loads for Crane Lifts" (AM—April 22 '57 p 129)**

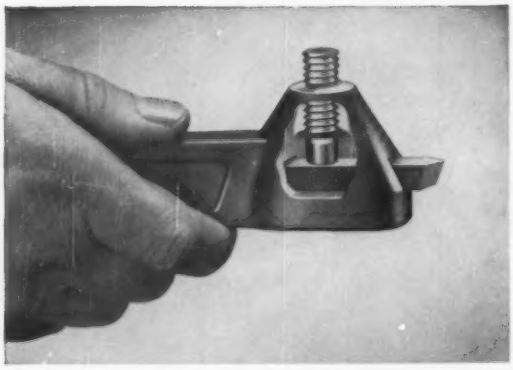
**ALLOY-STEEL CHAIN SLINGS**

| Alloy Chain Diameter | Straight 1 Leg | Choker 1 Leg | 60° Choker 2 Leg | 45° Choker 2 Leg | 30° Choker 2 Leg |
|---|---|---|---|---|---|
| Inches | Tons | Tons | Tons | Tons | Tons |
| ¼ | 1 | ¾ | 1½ | 1¼ | ¾ |
| ⅜ | 2 | 1½ | 3 | 2½ | 1½ |
| ½ | 3½ | 3 | 5 | 4 | 3 |
| ⅝ | 5½ | 4 | 7½ | 6 | 4 |
| ¾ | 8 | 6 | 11 | 9 | 6 |
| ⅞ | 10 | 8 | 14 | 12 | 8 |
| 1 | 14 | 11 | 19 | 15 | 11 |
| 1⅛ | 16 | 13 | 22 | 18 | 13 |
| 1¼ | 21 | 16 | 28 | 23 | 16 |
| 1½ | 27 | 21 | 37 | 30 | 21 |
| 1¾ | 36 | 30 | 50 | 41 | 30 |

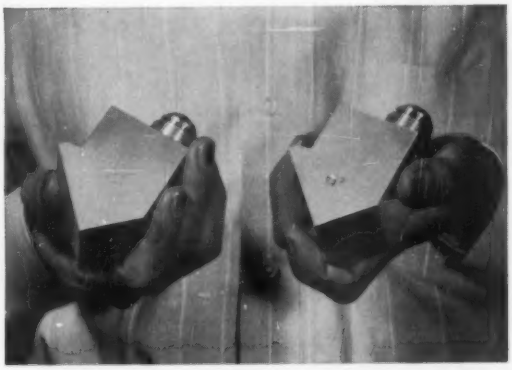
| Wire Rope Diameter |  60° Basket 2 Leg | 45° Basket 2 Leg | 30° Basket 2 Leg | 60° Basket 4 Leg | 45° Basket 4 Leg | 30° Basket 4 Leg |
|---|---|---|---|---|---|---|
| Inches | Tons | Tons | Tons | Tons | Tons | Tons |
| ¼ | ⅔ | ½ | ⅓ | 1 | 1 | ¾ |
| ⅜ | 1½ | 1 | ¾ | 3 | 2 | 1½ |
| ½ | 2½ | 2 | 1½ | 5 | 4 | 3 |
| ⅝ | 4 | 3 | 2 | 7 | 6 | 4 |
| ¾ | 5 | 4 | 3 | 11 | 9 | 6 |
| 1 | 9 | 7 | 5 | 18 | 15 | 10 |
| 1¼ | 13 | 11 | 7 | 26 | 21 | 15 |
| 1½ | 17 | 14 | 10 | 35 | 28 | 20 |
| 2 | 27 | 22 | 15 | 53 | 44 | 31 |
| 2½ | 38 | 31 | 22 | 75 | 61 | 43 |
| 3 | 49 | 40 | 29 | 97 | 80 | 56 |
| 3½ | 59 | 49 | 34 | 118 | 97 | 68 |

# Practical Tooling Tips

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

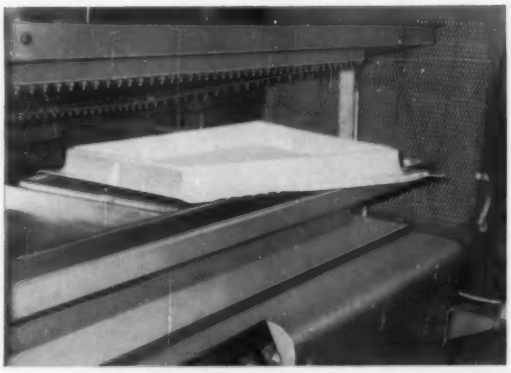


**TO GET GREATER TOOL BIT RIGIDITY** replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



**EASY WAY TO STOP MARRING** surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

**SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY**—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



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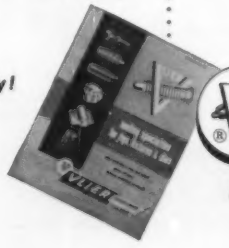

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# Dye Penetrant Inspection . . I

WILLIAM D BRIGGS, manager, Technical Dept, TURCO PRODUCTS, INC, LOS ANGELES, CALIF

The dye penetrant method is a precise process which, if properly used by trained technicians, can be a vital and beneficial tool in the fabrication of metals. However, if used improperly, this same tool can be a hazard by failing to locate dangerous flaws, or by indicating flaws in parts that are actually sound.

Accuracy of the penetrant-inspection process is to a great extent dependent upon following a set of established and proved procedures.

Briefly, the steps to be taken when performing a penetrant inspection are:

1. Clean the metal surface thoroughly.
2. Apply penetrant.
3. Remove surface penetrant with remover-emulsifier.
4. Dry the part.
5. Apply developer by spray.
6. Interpret results.

Surface soil not only can cover or bridge a flaw, inhibiting entrance of the dye penetrant, but it can also absorb the penetrant and render a false indication. Types of surface soil which must be removed include oil, rust, paint, carbon, grease, oxide, oxide deposits, residues from previous inspection methods, and any other foreign material.

Normal shop soils of the oily type can be removed by one of four methods:

1. By vapor degreaser.
2. By use of a solvent-type material which will not leave a residue.
3. By use of a free-rinsing alkaline hot-tank material.
4. By use of a free-rinsing steam-cleaning material.

Removal of rust and surface scale is accomplished by one of two methods:

1. By use of an akaline rust remover.
2. By use of acid de-rusting materials.

Paint films can be removed by one of the following methods:

1. By a bond-release paint stripper, either of the brush-on type or of the tank type.
2. By a dissolving-type hot-tank alkaline paint stripper.

Bond-release strippers are recommended for removing paint in most instances. A bond-release material destroys the substance which holds paint to metal. This action allows the paint film to be completely flushed from the surface of the metal with a pressure rinse. Bond-release strippers remove the paint film in large sheets, thus leaving the surface completely free from paint residues.

A dissolving-type stripper, on the other hand, actually dissolves or softens the paint coating layer-by-layer from the outside down to the base metal. This action, of course, presents the possibility of the dissolved paint filling defects. If it is necessary to use a dissolving-type stripper, thorough cleaning and rinsing are essential following the stripping operation.

Paint and carbon removal can also be accomplished by a two-layer solvent cold-tank material of the bond-release type. Materials of this type not only destroy the bond between the underlying surface and the paint film, but also destroy the binding substance that holds carbon to the metal.

Cleaning of jet engines prior to penetrant inspection has proved to be an unusually complex problem. During the operation of these high-speed engines, a tenacious oxide film is formed. Initial methods used in removing these deposits consisted of vapor blasting or liquid honing the part until all scale and oxide had been removed. These operations tend to fill very fine flaws with insoluble particles. Additionally, the abrasive particles can peen the metal surface to such an extent that some defects may be bridged and obscured.

Chemical processing is an alternative method for removing metallic oxides and heat-treat scale deposits. Use of strong acids is not recommended, because most acidic materials tend to create hydrogen embrittlement or affect the dimensional tolerances. The latest methods used in the removal of these tenacious oxides employ alkaline materials, which will remove the oxide film without danger to the underlying metal, and prepare the surface for penetrant inspection.

## APPLYING PENETRANT

Application of the dye penetrant is the second step in the inspection process.

The dye penetrant, usually red, covers the surface of the part but also completely fills all surface flaws, no matter how small.

Evaluation of the size, shape, and number of specific articles to be inspected will determine whether the spraying, brushing or dipping method of penetrant application should be employed. If only certain critical areas are to be inspected, application by spray or brush will reduce consumption of penetrant and will also facilitate penetrant removal. However, if a great number of small parts are to be inspected simultaneously, dip application will eliminate individual handling of parts.

If perforations are suspected to extend through the entire thickness of the part, the brush or spray method should be employed. In this application, the penetrant is applied to one surface of the part, and then the developer is applied to the opposite surface. Any flaws which extend completely through the article are shown immediately as red indications on the white developer background.

Under normal conditions a dwell time of from 3 to 10 min. should be allowed. Normal conditions are defined as temperature of parts between 70 and 120 F prior to penetrant appication. The table indicates suggested dwell times for checking various types of suspected flaws.

## REMOVING EXCESS PENETRANT

The excess surface penetrant must be completely removed from parts following the recommended penetrant dwell time. While it is essential that all penetrant be removed from the surface, care must be exercised to make certain that none of the penetrant is removed from the flaws themselves. Requirements are:

1. A penetrant that is not water soluble.
2. A remover-emulsifier which renders the penetrant water-removable.

This combination yields a process

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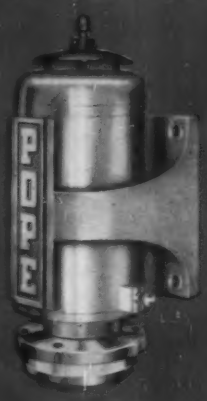


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# Dye Penetrant Inspection . . II

which allows the penetrant to be easily and completely removed from the *surface* of the part wherever the remover-emulsifier comes in contact with the surface penetrant. Because the remover-emulsifier does not come in contact with the penetrant in the flaws, water rinsing will not remove any penetrant from the flaws. The approved method for removing the excess penetrant is accomplished in this manner:

1. Apply remover-emulsifier over the area covered with dye penetrant (remover-emulsifier will emulsify surface penetrant).

2. Using a heavy volume of water, flush remover-emulsifier and excess penetrant, which has become water-removable, from the surface of part.

While the remover-emulsifier and water-rinse method of excess surface penetrant removal is normally employed, there is one other generally accepted method. This consists of applying remover-emulsifier by brush or swab and then wiping the surface clean with a dry cloth. This method is only recommended on very small parts, or where a water rinse cannot be employed.

**APPLYING DEVELOPER**

The developer serves two purposes:

1. Spray application of a fine film of developer on the part deposits a white coating which serves as a contrasting background for the red dye penetrant.

2. The liquid vehicle in the developer draws the penetrant from flaws to the surface of the developer film.

After excess penetrant has been removed and parts have been thoroughly dried, a thin, even coating of developer is sprayed onto the area being inspected. Spray application provides a thin, even coating, precluding laps and runs and insuring clear-cut flaw indications. A paint spray gun with a vaporizing tip, operated with a minimum flow of developer under 25 to 30 psi air pressure, should be used. Spraying provides almost instantaneous flaw indications as rapidly as parts can be handled. When spraying facilities using compressed air are not available, a light, even coating of developer may be applied by means of developer press-spray container.

When applying developer at temperatures below 60 F, refer to the penetration dwell-time table, allowing drying time equal to the penetrant dwell time.

**INTERPRETING RESULTS**

As the developer dries to a smooth, even white coating, red indications will appear at the location of defects. If no red indications appear, there are no surface flaws present. Depth of defects will be indicated by richness of color and speed of bleed-out. Types of defects will be like those shown above.

Red flaw indications will remain visible until wiped off manually. There is no need to re-work defective parts immediately.

While it is not necessary to remove the white powder coating of developer in all cases, the developer film can easily be removed with water or with dry cloths as desired.

If parts that have been inspected are to be stored, it is recommended that they be coated with a rust-preventive oil.

When dye-penetrant inspection processes were relatively new, the accuracy of these methods was questioned. Several different inspections were often performed on the same part. If magnetic-particle inspection has been used prior to a penetrant inspection, the residual iron-oxide material may bridge a defect, making it impossible to locate the same defect with a subsequent dye penetrant or fluorescent inspection. If fluorescent materials have been used to locate defects, complete removal of the fluorescent material is necessary prior to application of the dye-pentrant material. This can often be done by immersing the work in the liquid used in a trichlorethylene vapor degreaser.

It is not normally feasible or desirable to subject the same flaw to various inspection processes as a means of testing the accuracy of the various methods.

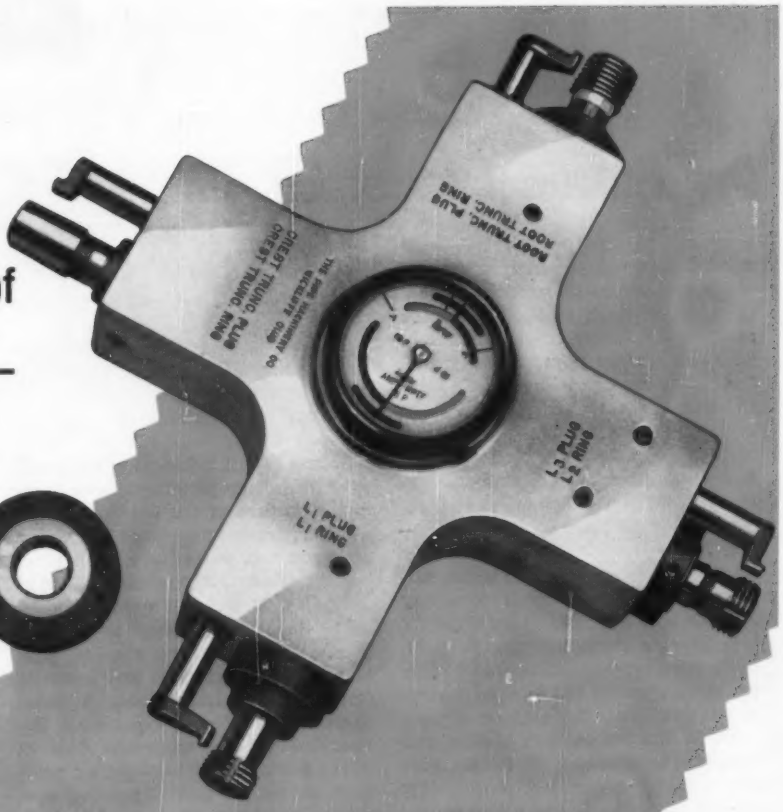
***SUGGESTED DWELL TIMES****

| MATERIAL & CONDITION | TYPE OF DEFECT | TEMP. 60 to 90 F | TEMP. 35 to 60 F | TEMP. 0 to 32 F |
|---|---|---|---|---|
| All Materials | Heat-Treat Cracks | 3-5 | 10-15 | 30-45 |
| All Materials | Grinding Cracks | 7-10 | 10-20 | 45-1 hr. |
| All Materials | Fatigue Cracks | 7-10 | 10-20 | 45-1 hr. |
| Plastics | Cracks | 3-5 | 10-15 | 30-45 |
| Ceramics | Cracks | 3-5 | 10-15 | 30-45 |
| Ceramics | Porosity | 3-5 | 10-15 | 30-45 |
| **Cutting Tools:** | | | | |
| Carbide Tips | Poor Braze | 3-5 | 10-15 | 30-45 |
| Cutting Tools | Crack in Tip | 3-5 | 10-15 | 30-45 |
| Cutting Tools | Crack in Steel | 3-5 | 10-15 | 30-45 |
| Perm. Mold Casting | Shrinkage Porosity | 3-5 | 10-15 | 30-45 |
| Die Casting | Surface Porosity | 3-5 | 10-15 | 30-45 |
| Die Casting | Cold Shuts | 3-5 | 10-15 | 30-45 |
| Forging | Cracks & Laps | 7-10 | 15-20 | 45-1 hr. |
| Metal Rollings | Seam | 7-10 | 15-20 | 45-1 hr. |
| Aluminum Welds | Cracks & Pores | 3-5 | 10-15 | 30-45 |
| Steel Welds | Cracks & Pores | 7-10 | 15-20 | 45-1 hr. |

**All dwell times in minutes unless othewise stated.*
*Parts Colder—Recommended temperature penetrating time can be increased.*
*Parts Warmer—Recommended temperature penetrating time can be decreased.*
*Note: When temperatures range from freezing and below, care should be taken to make certain that parts to be inspected are free from ice.*

# New!

## For Accurate Gaging of Precision Pipe Threads— ANPT, NPTF and NGT



## Pipe Machinery Correlchek Gage

**Here's What It Does For You!**

Inspects fittings as fast as they can be screwed on and off of the individual gages.

NO GUESSWORK ON STANDOFF. THERE IS NOTHING TO REMEMBER—NOTHING TO FIGURE—THE CORRELCHEK DOES IT ALL FOR YOU.

No complicated understanding of gaging required. Check on L-1, set bezel to indicator hand, check with other three gages to appropriate color tolerance zones. It's just that simple.

Wear on gages automatically compensated for by resetting Correlchek to masters.

Standard stock gages are used. You can use the ones you now have in your plant.

Correlchek unit is adaptable for either plugs or rings.

Standard Correlchek units can be used for sizes ⅛" thru ¾" nominal size. (Larger sizes available on request.)

Reduces scrap, reduces leakers, saves time—and discussions. Precise accuracy duplicated every time.

***For full details write us on your letterhead.***

**THE PIPE MACHINERY COMPANY**
**29100 Lakeland Blvd. • Wickliffe, Ohio**

*Greater Cleveland*

# Talking Shop...

## Advice by Mail

CARBORUNDUM has taken a leaf from the succes of the newspaper columnists who offer advice to readers by mail. They have set up a department to provide abrasive engineering service the same way. The service includes a prediction of savings over the old method that is claimed to have a batting average of 90% accuracy.

Traditional method of in-plant studies has bogged down with the rapid expansion of abrasive-belt methods. So engineers took the thousands of case studies in Carborundum's files and broke them down into classifications, isolated factors common to all of the classified types, isolated variables and resolved them into the least common denominator, and then reduced the data into formulas.

They call the service, "Maximum Automation Potential". Just write to MAP Dept, The Carborundum Co, Niagara Falls, NY, for a brochure that explains the service and provides a form to detail the problem on which you want engineering recommendations.

## Government List

INTERESTED in knowing what publications the government issued in 1790? Well, how about 1892? The Superintendent of Documents is now offering for sale a catalog listing selected publications of the Department of Commerce and its predecessor agencies from 1790 to 1955. There is no promise that the publications themselves are still available, but there is a list of libraries where copies can be found. The book is Catalog C 1.2: P 96 and the price is $2.75. This catalog covers the period to 1950 and there are four supplements ($1.75, 45c, 50c, 45c, respectively) to bring the list up to the end of 1955.

## Steel Extrusion

THE PAPERWEIGHT in our in-box (often buried under the influx of your letters) is a section of an aluminum extrusion that spells a familiar aluminum trade mark (Alcoa). It was made a decade or more ago to demonstrate the intricacy of extrusion possible with aluminum.

Vivid evidence of the progress in extrusion since then comes with word that Allegheny Ludlum has just extruded their trade mark in type 410 stainless steel. The total distance around the outside of the extrusion is ten times the cross-sectional area. This 10 to 1 ratio is a measure of the load put on the die and represents a die complexity that would have been considered impractical in steel extrusion until recently. The engineers at Allegheny Ludlum designed the die just to see if it could be done. The extrusions were then run in 12-foot lengths on production equipment at regular speeds and temperatures.

## Rare Metal Scrap

IF YOUR PRODUCTION operations, include working some of the more valuable metals, such as germanium, platinum, gold, or molybdenum, you may be eyeing the scrap with sad eyes. Castor Engineering Co., Carnegie, Penna, has set up a reclamation service to salvage these and other metals from processing scrap. Send them a 2-lb sample of the scrap for evaluation. This will determine whether the reclamation will save money over the conventional method of scrap sale.

## Gold Discarded

THERE HAS BEEN a change in the procedure for the finish on the earth satellites manufactured for Project Vanguard by Brooks & Perkins. In the article (*AM*—Jan 14 '57, p101) that broke into the public view the details of manufacture of these satellites, we said that the finished shell would be gold plated for visibility and ease of tracking.

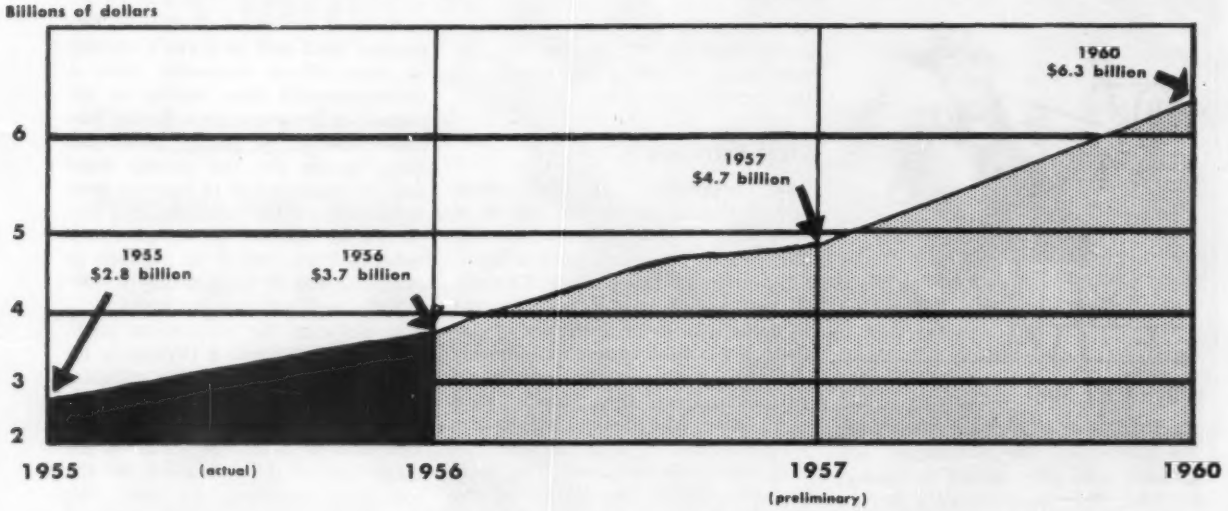
The gold plate has been discarded in favor of vaporized aluminum. The finished shell will be given a coating of clear silicon monoxide, then a microscopically thin coating of vaporized aluminum, and finally another coating of silicon monoxide. Main reason for the change from gold to aluminum is to increase heat reflectivity of the satellite. It is expected to operate in temperatures ranging from −200 F to perhaps as much as 600 F as it makes its 90-minute trips around the earth.

In drawing the magnesium shell, incidentally, Brooks & Perkins is lubricating the blanks with colloidal graphite in a naphtha suspension ('dag' 41). The same lubricant is also used both on the inside of the blank and on the spin block for the secondary spinning operation. We should have mentioned the form of lubricant when we described the process originally, but when it comes to hot drawing of magnesium, we have a tendency to take colloidal graphite for granted.

## Safe Machines

A BOUQUET to the safety designed into today's machine tools and other industrial machinery was tossed recently by Fred W. Braun, vice president in charge of accident prevention for Employers Mutuals of Wausau, Wis. "Human failure" now accounts for 85% of all industrial accidents in the U. S., and unsafe machinery just 15% — though 35 years ago the opposite was true. There were 95,000 persons killed accidentally last year, but only 14,300 of them died as a result of industrial accidents. The rest suffered mishaps in autos, homes, or elsewhere. But Braun cautioned, "Sad will be the day when management becomes satisfied with its safety record." And we add, what are you doing to make your plant safer in 1957?

# Metalworking Plans Huge 1957-1960




## Metalworking will do lion's share of U S product research . . .

**The metalworking industry will account for more than two-thirds of the $9.3 billion U S industry will spend annually on research and development by 1960. That figure is the total given by companies surveyed by McGraw-Hill. Actually, if the present rate of increase in research spending in Metalworking and in all industry continues, that total could well be much higher. Aircraft manufacturing research and development outlay ($3.1 billion by 1960) will account for just about half of all metalworking expenditures, and for one-third of the all-industry total. Also high on the list of 1960's research and development spenders will be the machinery industry ($704 million), and the electrical equipment industry ($1.6 billion)**

**NEW YORK — Metalworking companies plan to spend more than $4.6 billion this year for new plant and equipment. Their dollar outlay will be at or very close to the record-breaking pace of 1956.**

**They also have preliminary plans for spending $11.4 billion in the three-year period 1958-1960. If experience is any guide, the actual amount of money to be spent in that period will be considerably higher than that figure. As a spending period draws near, projects shape up that sharply raise the total.**

The amount of money going into research and development in the metalworking industries has risen from $2.8 billion in 1955 to $4.7 billion in 1957. The upsurge of such spending promises to continue. Metalworking companies plan to spend upward of $6 billion a year on research and development by 1960.

New products will represent a substantial proportion of Metalworking's total sales by 1960, a logical outgrowth of major spending for research and development. Close to 20% of 1960 sales in the machinery and electrical machinery industries will be in products not made in 1956. In transportation equipment (aircraft, ships, railroad equipment) well over one-third of the sales in 1960 will be of products not on the market during 1956.

### Survey Highlights

These are the highlights for Metalworking of the tenth annual survey of business' plans for new plant and equipment 1957-1960, conducted by the McGraw-Hill Department of Economics. Other findings are:

- **Transportation equipment,** to which aircraft manufacture contributes strongly, will chalk up a gain of 56% in its capital spending this year compared with last. Moreover, its spending in 1958 will be at about the same level in 1958 as in 1957.
- **Electrical machinery** industry will boost expenditures 18% in 1957, level them out in 1958 and 1959, and then increase them again in 1960, thus providing one of the best examples of long-range planning.
- **The machinery industry** plans to continue outlays of almost $1 billion a year right through 1960. This is about the same level as in 1956 and 1957.
- **The automobile industry's** capital expenditures for 1957 show a sharp drop of 29% from 1956 levels, will drop again in 1958 to less than half the 1956 level. After that, the industry cannot say which way spending will go.

Nevertheless, the automotive industry is one of four which plans to spend more than $1 billion for new plant and equipment this year. The others: steel, machinery, and chemicals. But only two of these plan to top $1 billion in 1958 and 1959—steel and chemicals. The latter industry expects to spend nearly $2 billion a year for four years in a row.

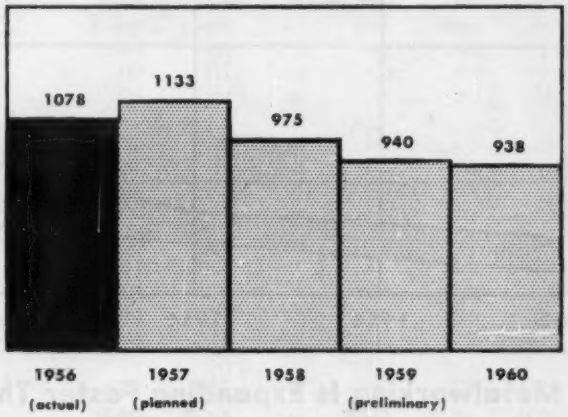
- **The steel and nonferrous** metal-producing industries are continuing their strong expansion programs, will hit new highs this year (steel capital spending is up 42% this year, nonferrous metals 66%). But this will drop noticeably in 1958, as the projected expansion tapers. But both industries will maintain a high lev-

(continued on page 164)

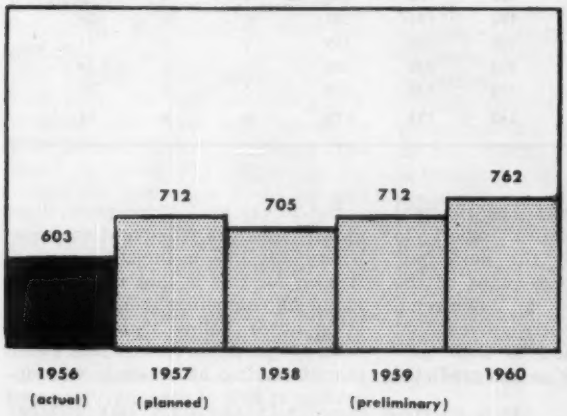
# Capital Outlays

**. . . The spectacular increase in spending for research between 1955 and 1960, as shown on the opposite page, gives added meaning to the charts on this page. It means that the preliminary plants for 1958 to 1960, as revealed by the survey, are almost sure to be the bare minimum of outlay for new plant and equipment. Final spending will be a lot more as a result of the new facilities required to manufacture all the new products that metalworking companies expect to put on the market up through 1960. With this factor in mind, dollar spending three years from now may well surpass that of 1957 in all the main segments of Metalworking.**

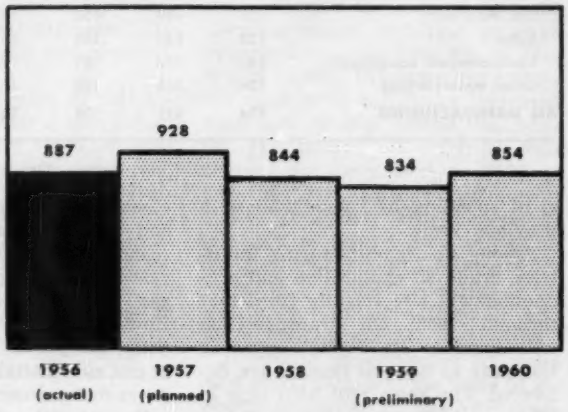
**MACHINERY:**
**Capital spending is increasing this year, will be steady at $1 billion in 1958-1960**



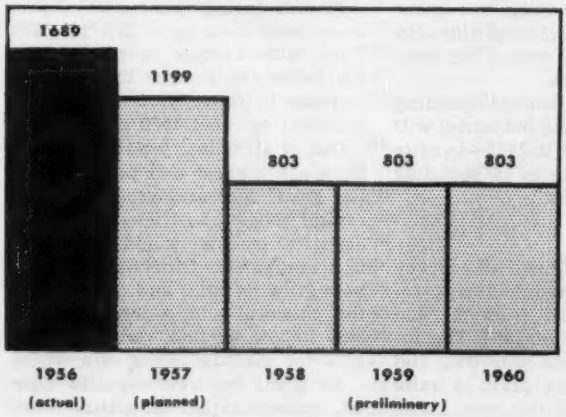

**ELECTRICAL MACHINERY:**
**Spending will go up 17% this year, level out in 1958-59, then increase again in 1960**



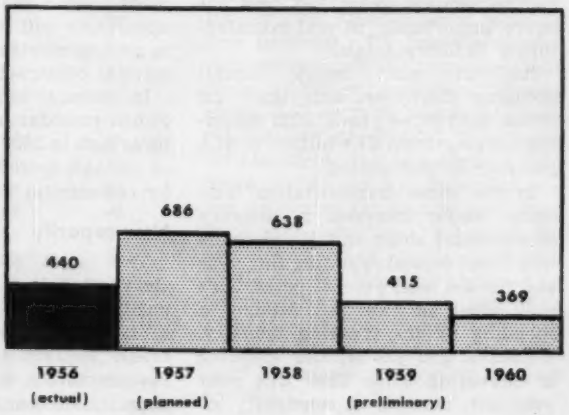

**OTHER METALWORKING:**
**Capital goods spending in this field will be higher in 1960 than in the next two years**

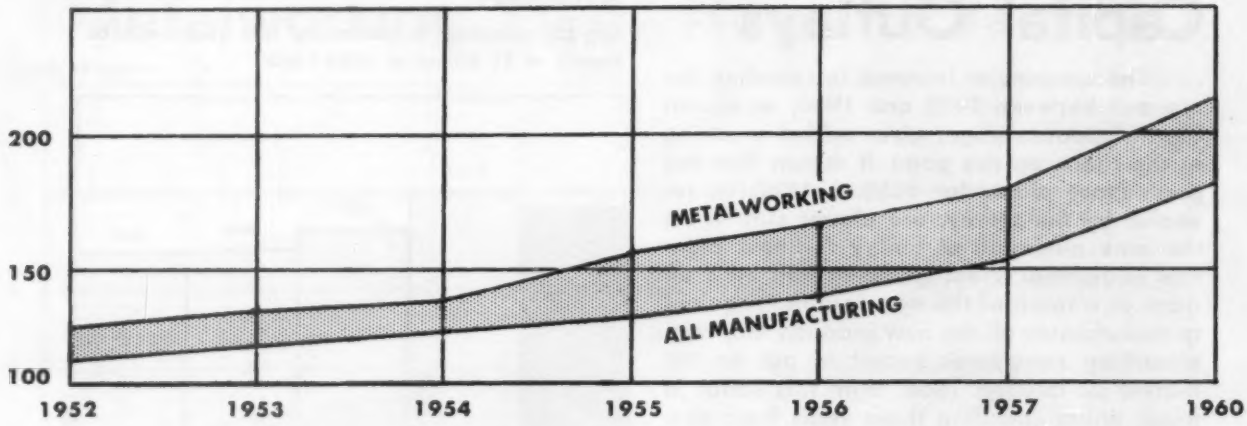



**AUTOS, TRUCKS AND PARTS:**
**Spending will be down sharply this year and next. After that it's anybody's guess**




**OTHER TRANSPORTATION:**
**(includes planes but not autos) will jump 56% this year over 1956, stay at that level in '58**






## Metalworking Is Expanding Faster Than Industry As a Whole

(Index of industrial capacity (1950 = 100)

| | | | | | | Planned | | Percent increase | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1960 | 55-56 | 56-57 | 57-60 |
| ALL METALWORKING | 121 | 133 | 141 | 151 | 166 | 178 | 210 | 10 | 6 | 18 |
| Machinery | 123 | 130 | 137 | 147 | 165 | 178 | 208 | 12 | 8 | 17 |
| Elec Machinery | 123 | 139 | 150 | 162 | 178 | 196 | 247 | 10 | 10 | 26 |
| Autos | 128 | 132 | 140 | 151 | 165 | 170 | 189 | 9 | 3 | 11 |
| Transportation equipment | 147 | 172 | 181 | 195 | 216 | 233 | 266 | 11 | 8 | 14 |
| Other metalworking | 109 | 116 | 122 | 131 | 138 | 146 | 175 | 5 | 6 | 20 |
| ALL MANUFACTURING | 114 | 121 | 126 | 134 | 142 | 151 | 174 | 6 | 6 | 15 |

el of spending by comparison with previous years.

Among non-manufacturing industries, crude oil exploration and production will rise steadily from 1957 through 1960. Oil transportation will increase its capital spending this year as new oil tankers are delivered. The same will hold true in 1958 and 1959. In all, the oil industry will spend $6 billion a year for the next four years.

Mining industries' spending fluctuates widely in plans for this year and subsequent years, but does not figure importantly in non-manufacturing industry totals.

Railroads plan heavy capital spending this year, will taper off in the next three years, with spending varying from $1.4 billion to $1.1 per year in that period.

In the "other transportation" category, major increases in delivery of merchant ships and jet airliners will boost capital spending this year and for the next several years. This will offset an expected decline in spending by the trucking industry.

Electric and gas utilities spending is increasing some 22% this year over last, because of constantly increasing power needs. Electric light and power companies expect to spend heavily over the next four years, but long-range plans of the gas utilities show a downtrend. However, it has been proved that these companies add to their programs substantially as the predicted years draw closer.

Commercial companies (mostly large chain stores, department stores, banks and insurance companies) expect to spend just about the same amount this year as last, but then plans show a sharp drop. The latter apparently will result from difficulty in getting mortgage money for commercial construction.

In essence: total capital spending of non-manufacturing industries will be as high in 1958 as in 1957—in spite of an anticipated drop in spending by commercial firms.

### New capacity

The latest McGraw-Hill survey shows that U S manufacturing capacity increased 42% from the end of 1950 to the end of 1956. The increase in 1956 alone was 6%, and manufacturing firms plan to raise capacity another 6% this year.

But in the next three years those same companies will boost their capacity only 15% in the entire period. Reason for this is that most manufacturing companies today are operating at or below their preferred rates of operation. At last year's end, manufacturing as a whole was operating at 86% of capacity, compared to an average preferred rate of 90%. Only three industries—steel, nonferrous metals; and stone, clay and glass were operating significantly above their preferred rates.

Manufacturing companies expect to increase their sales 26% by 1960. Thus, with average operating rates 4% below the desired level, a 22% increase in capacity should be just sufficient to meet 1960 needs.

Out of all industry, sales expectations are highest and planned capital goods increases greatest in the capital goods industries—machinery, electrical machinery and transportation equipment. Others who anticipate growing sales and capacity are the chemical and paper industries: 30% to 36% by 1960, compared with 26% for manufacturing as a whole.

As plans for new capacity taper off, modernization is getting more

and more attention from industry. This year, plans call for 52% of capital spending to be on expansion, 48% on modernization. But in 1958-1960 plans, the percentages are almost exactly reversed (modernization will take 53%).

Biggest shifts toward modernization are evident in plans of the nonferrous metals, machinery, food and textile industries for 1958-60. In some cases the shift has already started——notably in food, textiles, automobiles, and petroleum refining —where 60% to 80% of all spending will go into modernization this year.

### Research and new products

More facilities to make new products are causing a step-up in industry's capital spending plans and its research efforts. More new products will reach the market in 1957-1960 than in any four-year period in history.

To achieve this end, research and development are being stepped up drastically. For instance, 1956 saw $6.1 billion spent by industry for this purpose—28% more than in 1955. Plans for 1957 indicate a 20% increase over the 1956 figure—to $7.3 billion. Industry already has plans to spend $9.3 billion on research by 1960. And if the present rate of increase continues, the actual amount will be far higher than is indicated in this preliminary estimate.

Every reporting industry intends to increase its research and development spending this year, with the largest and most spectacular gains reported by aircraft manufacturing, machinery, electrical equipment, instrument, and the oil and chemical industries.

While the full results of this increase in R & D spending won't show up for several years (it takes time to translate research into commercial products), many companies are already increasing their capital expenditures to bring out new products. In manufacturing as a whole, 32% of all companies expect to spend money for that purpose in 1957, compared to 28% in 1956.

Some industries show much sharper gains in R & D spending, such as steel, wherein the number of firms planning capital spending to make new products rose from 6% in 1956 to 21% in 1957. In nonferrous metals, the number of companies increased from 25% to 42% during that period. The figures for electrical machinery are from 44% in 1956 to 65% in 1957, transport equipment 31% to 45%, and "other metalworking" 23% to 42%. A good half of all chemical companies plan investment to bring out new products—so do nearly half of all automobile and parts producers.

If capital expenditures to make new products follow the trend of research spending, it looks as if nearly half of all manufacturing firms will be spending for this by 1960.

### 10% New Products by 1960

Manufacturers now expect about 10% of 1960 sales volumes to be in new products. (By "new products" the survey means products "not made in 1956, or products sufficiently changed so as to be reasonably considered new products".) This figure for manufacturing as a whole is held down somewhat by the relatively low estimates for metals and other basic materials. Thus, a typical figure for finished goods producers would be considerably higher. The chemical industry expects 16% of its 1960 sales to be in new products. Other industries range up to the aircraft industry's nearly-40% increase by 1960.

## CAPITAL SPENDING PLANS 1956-1960

(millions of dollars)

| | 1956 Actual | 1957 Planned | 1956-57 % change | Preliminary plans 1958 | 1959 | 1960 |
|---|---|---|---|---|---|---|
| **ALL METALWORKING** | $ 4697 | 4658 | – 1% | 3965 | 3704 | 3726 |
| Machinery | 1078 | 1133 | + 5 | 975 | 940 | 938 |
| Elec. Machinery | 603 | 712 | +18 | 705 | 712 | 762 |
| Autos, trucks, parts | 1689 | 1199 | –29 | 803 | 803 | 803 |
| Transportation equipment (planes, ships, railroads, equip) | 440 | 686 | +56 | 638 | 415 | 369 |
| Other metalworking | 887 | 928 | + 5 | 844 | 834 | 854 |
| Iron and steel | 1336 | 1897 | +42 | 1328 | 1102 | 992 |
| Nonferrous metals | 601 | 998 | +66 | 609 | 353 | 293 |
| **ALL MANUFACTURING** | 12,787 | 14,542 | +14 | 12,390 | 11,057 | 10,601 |
| Petroleum industry | 5531 | 6166 | +11 | 6421 | 6276 | 6081 |
| Railroads | 1231 | 1366 | +11 | 1188 | 1129 | 1152 |
| Electric, gas utilities | 4895 | 5991 | +22 | 5880 | 5238 | 5113 |
| Commercial | 8236 | 8401 | + 2 | 8065 | 7178 | 6317 |
| Communications, other transportation | 4229 | 4963 | + 7 | 5060 | 5590 | 5950 |
| **ALL BUSINESS** | 36,641 | 40,979 | +12 | 38,397 | 35,911 | 34,767 |

## WHERE THE CAPITAL SPENDING DOLLAR GOES

| | Percent of Capital Spending Planned for: 1957 | | 1958-1960 | |
|---|---|---|---|---|
| | Expansion | Replacement & Modernization | Expansion | Replacement & Modernization |
| Iron & steel | 60% | 40% | 53% | 47% |
| Nonferrous metals | 90 | 10 | 72 | 28 |
| Machinery | 52 | 48 | 36 | 64 |
| Electrical machinery | 61 | 39 | 61 | 39 |
| Autos, trucks & parts | 30 | 70 | 48 | 52 |
| Transportation equipment (aircraft, ships, R R equip.) | 46 | 54 | 37 | 63 |
| Other metalworking | 40 | 60 | 48 | 52 |
| Chemicals | 68 | 32 | 64 | 36 |
| Paper & pulp | 53 | 47 | 54 | 46 |
| Rubber | 45 | 55 | 45 | 55 |
| Stone, clay & glass | 64 | 36 | 60 | 40 |
| Petroleum refining | 20 | 80 | 22 | 78 |
| Food & beverages | 40 | 60 | 29 | 71 |
| Textiles | 26 | 74 | 13 | 87 |
| Miscellaneous manufacturing | 50 | 50 | 43 | 57 |
| **ALL MANUFACTURING** | 52 | 48 | 47 | 53 |

**1 . . .**
First step in programming for numerical control is to modify a conventional drawing into a "numerical drawing" (all dimensions perpendicular or parallel to a predetermined reference point). This handwritten process sheet is then made

**2 . . .**
Next, a Flexowriter prepares a paper process tape, putting the blueprint data into code form. Simultaneously, a typewritten sheet is made with the same information to provide a record and a means of quick checking

# Milling Plane Parts with Tape

**DETROIT—Reduced tool costs and lead time, better finishes, less scrap, and higher part quality are among the many advantages expected from a numerically controlled milling machine demonstrated here by The Martin Company and Bendix Aviation Corp. The machine is a 50-ton, three-axis miller built by Kearney and Trecker Corp especially for use with a continuous-path numerical control system developed by the Bendix Research Laboratories.**

Martin will use this automatic production machine at its Baltimore Division to manufacture parts for the TM-61 Matador tactical missile and the P6M Seamaster four-jet-engine seaplane. G T Willey, vice president of manufacturing at Martin, said the new machine will eliminate weeks of tool setup and tool-changing time —"the most time-consuming operations in airframe manufacture"—and will also eliminate fixtures, templets, and other tools previously an expensive part of airframe production. Other expected gains include reduction of scrap, minimum inspection time, and increased tool life.

Dangers of operator error are avoided because the control is not affected by such variables as operator fatigue, distraction, or interruption. Because only a visual check is required, after the first correct piece is made, inspection time is cut. With automatically controlled and constant feed rate, greater tool efficiency is obtained.

### More machining coming

Main reason for going to numerically controlled milling, according to Mr Willey, is the current trend toward greater use of machined forgings, castings, and extrusions in airframe manufacture—the emphasis on finishing operations requiring contouring. Even at today's peacetime production rate, Martin's machine shop is working at capacity. Machining operations on future airframe designs are expected to increase considerably both from the standpoint of component complexity, including tighter tolerances, and because of materials more difficult to work.

Many months ago, in anticipation of the arrival of this machine, Martin took steps to orient and train both design and manufacturing people to this new control concept. The changes to come with numerically controlled milling will begin on the designer's desk. Certain design elements will be standardized and coded for storage in the memory unit of the system. After that, the machining operation can proceed with only a call-out symbol or equation included in the numerical design of a part.

Operation of the new system will be by a team consisting of a numerical processor, Flexowriter operator, computer operator, and a machine operator. This team, including the machine operator, can serve a number of machines. The operator, largely an observer, sets up the part for cutting, loads and unloads the tape, changes cutters, and makes the necessary adjustments. No manual control is needed.

Information blocks on the tape, each of which is no more than 2.1 inches long, numerically specify coordinate dimensions of a point along the cutter path, the feed rate between consecutive points, and auxiliary machine-control commands. Complete and continuous control information for pocket milling or other operations is computed from a specified profile and the desired cutter path. Because the taped information is complete in itself, no further computation is required at the machine.

Tape-controlled machine tools have a broad potential in much of Metalworking, according to Murray Kanes, head of the electro-mechanical department at Bendix Research Laboratories. "They could produce

**3 . . .**
Computing equipment translates the paper process tape into commands, which are received in perforated form on plastic control tape by the machine. Here, operator uses master writer. Computer is in background. On desk at operator's right is the control tape preparation unit

**4 . . .**
The milling machine itself is a 3-axis horizontal bed-type Kearney & Trecker unit specially designed for this application. Considerably more rugged than is usual for machines of this size and type, this K & T miller has ball and roller bearings in lead screws, fast and accurate hydraulic servo drives, and ways that cut down on friction. Machine control unit, into which tape is loaded, is behind the operator. Plug-in electronic units have pull knobs. The 20-hp machine has 16 spindle speeds in a range of 36 to 1800 rpm. Feeds for each axis are from 0 to 50 ipm: rapid traverse is 120 ipm

# Controls

body dies," he said, speaking of the automotive industry, "in about one-fourth of the time required under present methods." This system is also an answer to the cost problems of small and medium-size businesses confronted with short-run job-lot manufacturing because it provides economical changeover and low tooling inventory and investment as well as considerable flexibility. Numerical control, by providing a sizable extension of facilities, adds greatly to the potential of a shop's ability to accept work. Also, it simplifies use of prototypes.

Instead of intricate and expensive tooling, changeover from one job to another can be handled almost as simply as replacing one reel of tape with another, according to Mr Kanes. He also pointed out that training a process engineer to transcribe the necessary data from blueprint to NC program requires only a few days. Operation of the tape preparation equipment and the computer can also be learned in a short period.

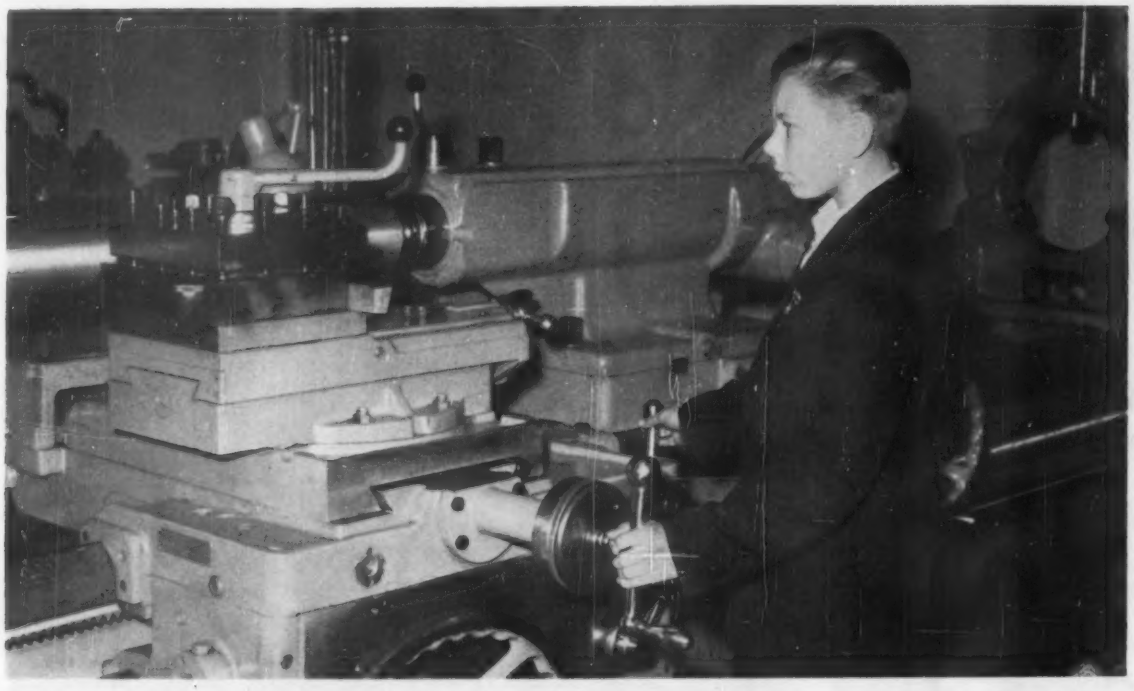
It is expected that computer service will be available at centrally placed organizations, especially to serve the smaller firms which do not have sufficient activity to warrant a computer on the premises.

While numerical control is, at present, best applied to the short-run jobs which otherwise require extensive tooling and setup, the continuous-path system built for Martin is not the only type in use. Actually, the control concept is divided into four phases of which continuous-path systems are the highest order. The simplest form is the Class I "tape templet" such as is used to direct an automatic riveter. Class II is a cycle programmer which provides control for repetitive cycles as in a stretch press and Class III is a discrete positioner such as is used to operate positioning table for drill-presses, jig borers, and turret lathes.

Continuous-path control systems are considered Class IV, the ultimate. They encompass the most complex control problems which, when resolved, will automatically resolve most of the problems of Classes I, II, and III. Thus, development emphasis is on the Class IV systems—but many of the present most practical applications are simple.

"Numerical control" should be thought of as a basic process-control concept, as an advance over the use of cams, templets, and other measuring, sequencing and timing devices. It can be used in plating, welding, riveting, assembly, presswork, and many other non-machining operations as well as in controlling any machine tool requiring repetitive operator skill, or complex tooling, as a factor in production. Whether or not it will suit *your* needs depends upon the break-even point. Compare your present cost of tooling, setup, labor, and scrap, as well as lead time and floor space against the cost of NC equipment, programming, and setup time. Which system provides the most profitable part cost? Even when production quantities warrant other methods, NC can lower tool-making costs.

FOREIGN REPORT ...No. 8 on Russia



# Mass-Producing Engineers for

**MOSCOW (Special to American Machinist)—Soviet technical training has come in for much newspaper and magazine mention in recent months—ever since it was discovered that Russia has put such training on a mass production basis in an effort to outstrip the West.**

**Just what are the underlying motives behind Russia's drive to create armies of engineers and scientists? How is it being done?**

To answer these questions it is first necessary to realize that Russia was underdeveloped industrially just three decades ago.

Contrast that with the Russia of today: 6.5 million of its workers have received either advanced or specialized education. In 1954, the latest year for which statistics are available, some 1.7-million people between the ages of 17 and 35 were enrolled in universities and full-time polytechnical institutes, or were taking correspondence courses in specialized subjects. And last year there were more than 1.6-million teachers on the faculties of Russian schools. This year there are even more!

Two basic Russian attitudes have made this possible. First, there is no more honored position in the Soviet Union than that of teacher. To the Russian it is inconceivable that teachers would be so poorly paid and occupy such a low position on the economic scale that they would be forced, with the exception of a dedicated few, to go into other occupations.

Second is the attitude of Russian youth toward higher education. As the head of one of Moscow's leading technological institutes put it, "They would bring in a bed and sleep here, if it weren't that their parents expect them home. We are always full. The students come here because that is what they have made up their minds to do. It is a goal they have achieved."

### Technology Starts Early

Primary schooling is compulsory today in all of Russia, and in the industrial areas both primary and secondary schooling (ages 7 to 17) is compulsory. The secondary (high) schools today incorporate technological training. After completion of the 10 years' compulsory education, these avenues are open to students: working toward a degree from one of Russia's 33 universities, or toward a diploma from a technological college, part-time or evening study at a technological college; or qualification by examination to take a correspondence course.

Odessa, for example, a medium-sized city with a fair amount of industry, has a 2000-student university, and 16 polytechnical institutes, each specializing in a different curriculum, ranging from pathology to refrigeration engineering. One such institute can take as many as 3000 students.

Industrial plants not only cooperate fully with these schools, they also maintain their own trade schools. In one Odessa plant, the trade school has three grades, teaching all the crafts employed in the plant. A Moscow plant employing 4000 has a complete four-year course in theoretical and practical training, plus evening courses. Some 300 students attend the latter, and 400 attend during the day as part-time students. The plant has a permanent faculty of 40.

**Cutting tool research laboratory at "Stankin" Institute . . .**
has dynamometers fitted to each machine tool to check cutting forces. This lab is available only to third-year-and-upward students

# Soviet Metalworking

Another plant, employing 2500, has an apprentice school, evening classes, and a technical school with a 4½-year curriculum. It is common practice for such in-plant schools to accept students from "outside." While this obviously provides the plant with a source of trained specialists, the outside student is under no obligation to work there after he finishes his courses. Generally, such courses are the equivalent of our apprentice training, but they teach theory as well as practice.

As an example of what Soviet higher education is doing for metalworking, let's look at Moscow's Machine Tool Institute, which specializes in training designers and technicians for the machine tool and small tool industries. According to its director, the "Stankin" (a nickname derived from its initials) Institute is "the leading one of its kind, not only in the Soviet Union, but in the world."

He may well be right. Stankin has 2000 students on full time and 1000 more attending evening classes. The full-time course takes five years, the evening course six years. During that time, the student devotes 4500 hours to theory, the rest to practical work, plus plenty of homework. Even with its capacity for 3000 students, Stankin is no longer able to accommodate all who want to get in.

What is the secret of Stankin's success in so popularizing a specialized field of study that it turns students away from its doors? The director explains it this way:

- A spirit of competition for entry —"only the best" secondary school graduates win out in open examinations.
- The high caliber of students—each student is examined periodically and those who won't make the grade are weeded out to make room for others.
- Compulsory lecture attendance—by law all students are obliged to attend theory lectures unless they have a valid excuse for absence.
- The right combination of theory and practice.
- Pre-entry training—students who come to Stankin have had a broad basic education, and they have had a sense of the value of scholarship instilled in them.

Stankin is controlled by the Ministry of Higher Education, and is so conceived as to graduate its students with specialized knowledge in all the principal fields of metalworking: machine tool design, production engineering, control operations, automation and transfer mechanisms, presswork, chipless production, gaging and gaging techniques, and so on.

While the student body is predominantly male, some of the day courses, particularly the ones dealing with gaging, have 30% girl students. This percentage is also borne out in the plants themselves, where the precision inspection departments are largely staffed by women, but not necessarily with those who have a higher education.

### First 2½ Years Non-Specialized

Stankin is very much alive to the dangers of over-specialized education. Thus its curriculum has been designed to give all students as wide a general background as is possible. There is no specialization in the first 2½ years. All students are taught such general engineering subjects as mathematics, physics, chemistry, theoretical mechanics, strength of materials, metallurgy, machine theory, basic principles of machine tool design, hydraulics and others.

Stankin has well-equipped workshops for practical work during these years, with facilities provided for metal cutting, welding, casting, forging and various other metalworking techniques.

Specialization and outside experience both begin with the third year, when each student is assigned to a plant for five weeks. Those taking machine tool classes generally work as machine operators, and are paid for the in-plant work they do. From here on out, the amount of outside work builds up, with many students working voluntarily in plants during the summer holiday. They replace regular workers and are paid at the same rates.

The special subjects a student can take from his third year on out allow a wide latitude: theory of metalcutting machinery, theory and practice of cutting tools, industrial economics, planning of metalworking plants and organization, calculation and design for metalworking processes, technology of machinery, buildings and machine foundations, and safety techniques, among others.

In the fourth year, outside practical experience increases to seven weeks, but takes a more advanced

## MASS-PRODUCING ENGINEERS IN RUSSIA (continued)

form—with accent on designing and production engineering. Students are taken into the design departments of plants, where they are given a job to carry out. According to a student's specialty he may be asked to carry out a production planning or production engineering project, design cutting tools for a given job, or in the instrument field be set a task involving design, selection and use of measuring instruments. The results of such assignments are assessed independently by Stankin, and by the chief design engineer of the plant.

### Pre-Diploma Practice

Practical training in the fifth and final year increases to nine weeks. This is known as pre-diploma practice, and it must result in a work that is of practical use to the industry. Not only that, the student must if necessary defend it in his final examination. But by the time he reaches this stage he will already have carried out three similar projects during his five years' study.

Typical projects: designing machine tool components, designing handling mechanisms, planning a technical process (if the student is specializing in production engineering), or planning a design project.

One such project completed by a student was a design for a hydraulic copying lathe—complete with working drawings of the hydraulic and electrical system, gearboxes, etc, to such a degree that the lathe could have been built without reference to any outside source.

When ready to do his diploma project, the student is sent to a plant to do the job. This means he's utterly on his own, can't rely on help from fellow students, or play upon known teaching quirks of instructors.

Projects similar to the design of the hydraulic lathe apply in other fields. If a student's specialty is production planning, his diploma project might be the complete production planning for a new high-quality production shop. Or if he is studying machine design, his task might be to design a new machine tool, taking into account foreign developments as well as Russian ones.

What about shop practice at Stankin? By way of illustration let's look at a typical student's schedule in advanced cutting tool design. The shop itself has dynamometers fitted to all its machines to facilitate metal-cutting research. There are three lathes, milling machines, a surface grinder, and drilling machines, among others.

This shop is used only by advanced students in cutting tool design and application. Each of these students has a special schedule drawn up for him, in which he is assigned eight workshop jobs that will put his theories into practice. The shop is also used for advanced research, which may or may not be in the curriculum. Third year students and upwards can use the shop for this purpose.

As previously mentioned, each student is required to complete eight shop experiments before graduation. In the metal-cutting curriculum, experiments cover such fields as cutting tool geometry, metal deformation during cutting, calibration of a lathe dynamometer and use of a dynamometer to measure cutting forces during milling, measurement of temperature during cutting, wear of cutting tools, influence of cutting techniques and the geometry of cutting tools on surface finish, geometry of drills, calibration of a dynamometer for a drilling machine, measurement of cutting forces in drilling and boring, and tool geometry for milling cutters, broaches and twist drills.

Stankin Institute insists that "design and technology should cooperate"—that before a student graduates into a state design bureau, he must have had plant experience as a machine operator, that he must by his own merit have achieved the grade of foreman and subsequently shop superintendent.

Proof that close relationship between school and industry practice pays off in Russia lies in the fact that as many as one-fifth of all diploma projects have actually been taken up by plants and put into production, or if a planning scheme is involved, put into actual operation in a plant.

### Exam to End All Exams

The graduation examination is more than a test of technical ability. It evaluates a student's initiative, his ability to defend his own judgment without preparation, and his ability to deal with subjects "off the cuff." All graduating students are heard by a state examination commission, which in the case of machine tools is made up of three or four teachers or specialists, three or four plant men, a production engineer, a designer, and an industrial economist. The head of the examining commission more often than not is from a rival school, which naturally makes it tougher on the student. The actual examination takes place this way: the student is called into a room before the commission and without any preliminary must justify his diploma, and explain everything to do with it—all without leads or questions from the examiners. At the end of 30 minutes he must answer critical questions, not only from the board but from any member of the public who happens to wander in off the street. Thus, confronted by someone who knows absolutely nothing about the subject, he has to clarify what he has said.

If a design student has introduced something new in his diploma project, he isn't asked how he solved an equation, or how he applied mathematics to its design. Rather, he is asked "Where did you get this from? Do you know another design like this? Why have you used this particular design?"

### Criticizing the Critics

After the questioning, the commission criticizes the student's diploma project right in front of him. If he doesn't agree with what is said, he can in turn criticize his critics and gets marks for it.

In reaching final decision, the committee takes into account another independent judgment—that of the chief designer or department head of a plant where the student's project has been sent for criticism. In the final grading, the commission alone can decide the student's classification, which can be one of five things: Grade One—"awful;" Grade Two—"unsatisfactory;" Grade Three—"fair;" Grade Four—"good;" and Grade Five—"excellent."

The number of failures is negligible. Most students fall into the Grade Four ("good") classification, and anywhere from 5 to 10% into the "excellent" category. If a student fails the final exam, the commission can place him in a different technological class, i.e., an engineer could be downgraded to technician. There are virtually no second chances to go back and retake a course or part of a course. In Russia, if you flunk you've had it!

# MACHINE TOOL CONTROL PROBLEM:
## How to Halt "Galloping Obsolescence"

**BUFFALO—The U S machine tool industry has reached a "new plateau" as a result of the unprecedented volume of business done last year. And this volume of business will probably continue as an expanding national economy requires the replacement of more and more obsolete machine tools, Ludlow King, executive vice president of the National Machine Tool Builders' Association, told some 500 engineers and executives representing 180 metalworking plants at the Westinghouse-sponsored 21st Machine Tool Electrification Forum here April 24-25.**

Research and development have assumed considerable importance in the machine tool industry, Mr King said, particularly in the light of current widespread interest in numerically controlled machines, recorded processing information, and other technical advances.

Also citing the vital need for replacement of what he called "galloping obsolescence" in machine tools, Jerome A Raterman, president of the Monarch Machine Tool Co and president of NMTBA, said that while there may not be so many machine tools purchased for expansion, increased buying for replacement is vital: "The pace of research and development, the push for higher standards of living, and the need for increased productivity per man hour make this inevitable."

Mr Raterman also stressed the benefits of accelerated depreciation under the "sum-of-the-digits" option in the Internal Revenue Act of 1954, under which a purchaser can write off about three-fourths of the original cost of a machine within the first half of the allowed depreciation period.

New machine tool developments, particularly in controls, have enabled machine tool builders to produce better machines today than ever before, Mr Raterman said. Consequently, older models are obsolescing faster than ever before.

Speaking, too, on the speedup in machine tool obsolescence, Ford Motor Co's J F Randall said that this is especially true in the automotive industry, where annual product design changes amount to some $320 million.

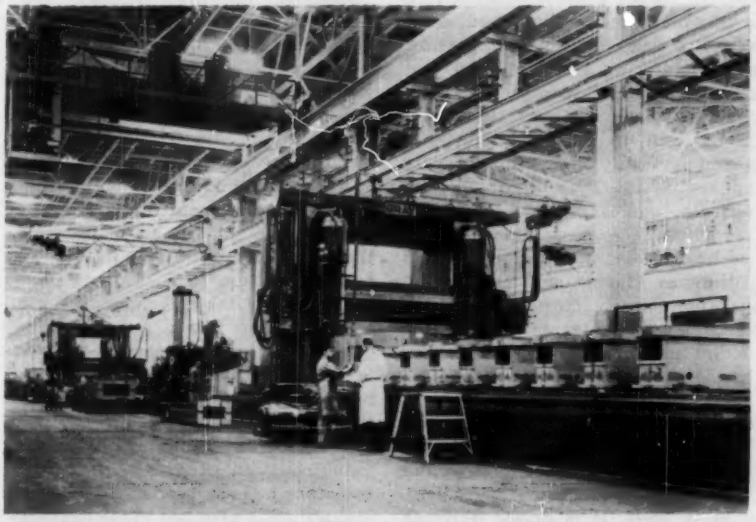
"It is up to industrial management," Mr Randall said, "to make the most efficient use of machine tools and to plan wisely. The high costs of obsolescence and downtime characteristic of modern high-production machine tools can be reduced with interchangeable machine components, unitized hydraulic and pneumatic systems, and unitized electrical plug-in controls."

New control developments cited:

- An automatic cycling grinder employs Cypak static controls for maximum reliability. Described by R C Montanus of Springfield Machine Tool Co and E B Ankenman of Westinghouse, this 4-head machine can do the work of four separate machines. Each head is capable of two grinding cycles, and any combination of heads can be used with either of the head cycles.
- A new tool for "debugging" modern equipment and for maintaining it after it is once set up was described by Kirk E Birrell of Sheffield Corp's Autometrology Division. This is the "MonitoRecord" sequence-time recorder that accurately times and graphically records the many operational events that go into a repetitive machine cycle.
- "Teleological control" (one that is directed toward a specific end-purpose) is a new concept in automatic controls. As described by Albert J Kerstukos of Westinghouse, a teleological control experiments until it finds a goal determined by a set of built-in rules. Such controls can cope with the problems of environmental disturbances, and they can maximize or minimize output without knowledge of all the variables involved. As a result, production processes can be designed without consideration of conventional control guidance.

### OBITUARY

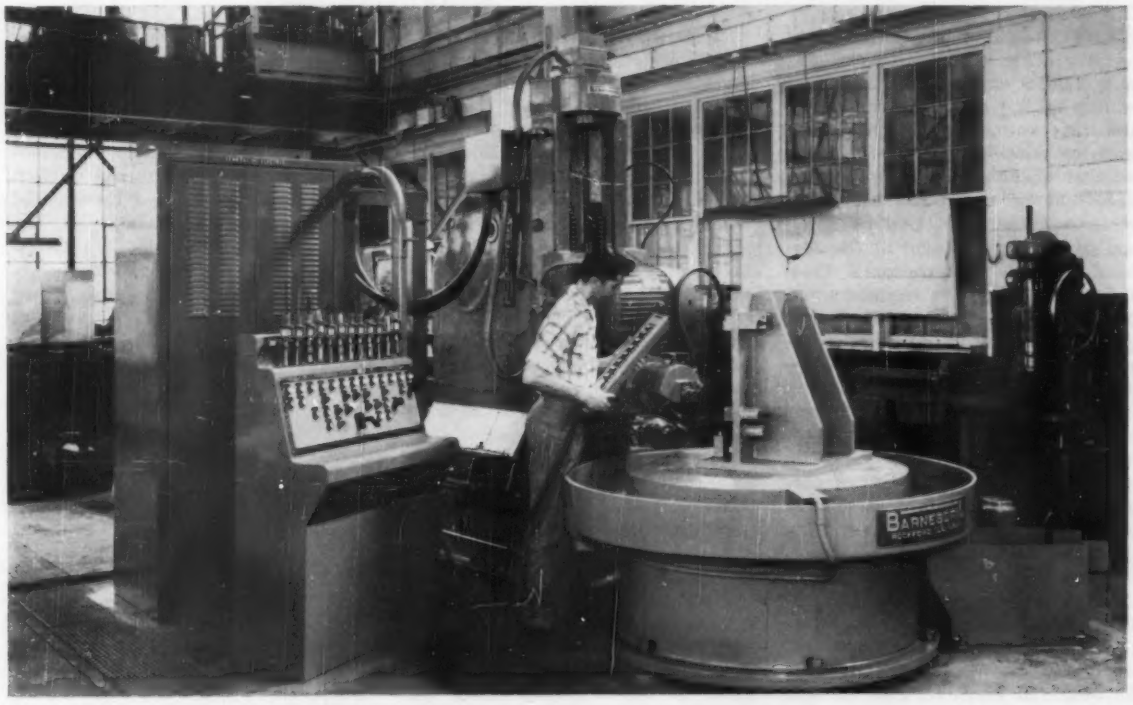
**Wendell Whipp,** chairman of the board, Monarch Machine Tool Co, Sidney, Ohio, died on April 27 when the boat in which he was fishing overturned on the lake adjoining the Monarch Rod and Gun Club near Sidney. Mr Whipp, who was 73 years old, was president of Monarch from 1931 to 1947, when he became chairman. He also was president of the National Machine Tool Builders' Assn 1938-1939.



**Elephant Tools Help Build Automation Machines**

. . . at the newly opened $6 million plant of the Cross Co at Fraser, Mich, (AM Apr 22 '57, p174)—said to be the first all-new U S plant devoted to the production of automation machinery. The plant's heavy, medium and light machining facilities are housed in three 60 x 700 ft bays

# New Shop Equipment



## Barnesdril Machine Features Numerical Control

Punched tapes control all functions of this numerically controlled, horizontal-spindle drilling, spotfacing, and chamfering machine. The machine is designed to machine radial holes in cylindrical parts up to 36-in. OD and up to 30 in. long supported vertically on an automatically indexed 40-in.-OD rotary table. A separate tape is used for each different job. This particular machine has been tooled for performing 248 drilling, spotfacing, and chamfering operations on aircraft gas turbine compressor housings, but is expected to find many other applications in the plant.

**Horizontal spindle**, 3-in. OD, is bored to take No. 3 Morse taper vertical adjustable adapters which permit the use of preset tooling, and has capacity for drilling ¼ to 1-in. holes in steel. It is driven through V-belts by a 4-speed, 2-hp constant horsepower motor, with speeds selected automatically by the punched tapes as programmed for the best machining practice.

The spindle is mounted in a vertically adjustable housing which, under the control of the punched tape, can be moved over a maximum distance of 30 in. by a 1-hp motor and ball-bearing precision leadscrew. Maximum speed is 60 ipm. A selsyn motor indicates the desired position of the spindle and feeds this information back to the control system. The controls are said to be so accurate that position of the spindle can be repeated within 0.001 in.

**The rotary table** is indexed by a 1½-hp motor under punched tape control. A selsyn motor geared to the table feeds position information back to control panel allowing position to be repeated within 0.001 in. on a 40-in. OD. Table position is automatically checked after the table is clamped. Once located, the table is hydraulically clamped to the flat supporting ways under the periphery of the table. Design of the table and machine base is such that it can hold more than 12,000-lb combined weight of workpiece and fixtures without distortion. This assures high locating accuracy for the lighter pieces for which the machine was designed.

**In-and-out movement** of drill head and column is provided by hydraulic cylinder, and includes rapid approach at 300 ipm and four feed rates each of which can be set between 0.5 and 11 ipm. Both spindle and column feeds are selected as designated by the tape. Controls are arranged so two feed rates can be used in sequence during any drilling cycle if part design makes this desirable. Three sets of cam-actuated limit switches provide three depths of penetration and rapid return as selected by punched tape. Because feed usually is to a positive stop, with depth of cut controlled by presetting the tool in its holder, depth of cut taken by the machine can be held within 0.001 in.

**Control console** houses all manual control elements and a tool control board. The tool control portion of the console has positions for holding

# Materials and Parts . . .

**Each tool support bracket is spring loaded to open limit switch when tool assembly is removed. Machine will not operate unless correct tool is selected**

up to 13 different tools, each preset in a holder. Any of the 13 positions can be locked out, according to job requirements. The machine will not function unless a tool is placed in each active position on top of the console, except for the tool designated by the tape as the one which should be in use.

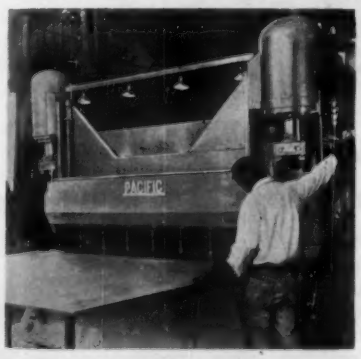
The control tape can be punched to designate tools in any required sequence. This permits tools on the board to be used in any sequence no matter what their position may be on the console. Thus, the arrangement need not be changed when jobs requiring different combinations of these tools are interchanged on the worktable.

**Tool selection** is pointed out by the tape. A signal light on the console is activated by the tape to show the operator the next tool to use when a step in the machining cycle has been completed. Then the operator must remove the previously used tool from the spindle, replace it in its proper position on the console, and take the indicated tool from its position before the machine can be restarted. As a safety feature, the machine does not start automatically after a tool change. Each new step in the cycle must be initiated by pressing a pushbutton on the console to insure that the operator has moved away from the spindle before it can be rotated.

**Control system** is built around a numerical positioning control developed specially for this machine by General Electric Co. It uses punched tapes to introduce dimensional control information to the machine through the Barnesdril console unit. Eight-hole, 1-in.-wide tapes (similar to those used in business machines) can be used in any lengths in this unit. Holes represent digital dimensions, each transverse row representing one digit. This control system can be modified to use any standard business machine cards punched with dimensional information, using a similar code.

All electrical and hydraulic systems used in this machine conform to JIC standards where applicable, and the machine is designed for easy maintenance should adjustments become necessary.

*Barnes Drill Co, Rockford, Ill*




## Adjustable Rake Angle Boosts Production on Hydraulic Shear

By adjusting rake angle of this ½-in.-capacity shear to ¾ in. per ft, shear will cut ¾-in. steel plate with the force normally required to cut ½-in. plate. In cutting ¼-in. steel, the rake angle is reduced to 3/32 in. per ft and the shear will cut strips 24 in. long at rates up to 60 per min with less twist and bow than with conventional shears.

For precision cutting, knife clearance can be rapidly adjusted to match plate thickness. Shear is said to cut quietly without shock, resulting in 2 to 3 times longer knife life. Ram, controlled by foot pedal, can be stopped instantly at any point.

*Pacific Industrial Mfg Co, 848 49th Ave, Oakland 1, Calif*

## . . . including


### MACHINE TOOLS AND ATTACHMENTS

Horizontal Boring Machine ..... 174
Milling Head ..... 175
Profile Miller ..... 175
Cutoff Saw ..... 176
Grinder ..... 180
Heavy-Duty Lathe ..... 180

### TOOLS AND ACCESSORIES

Indexing Head ..... 174
Parts Positioner ..... 176
Chamfering Tool ..... 178
Wheel Dresser ..... 182
Magnetic Chuck ..... 184

### FORMING

Expander ..... 178
Punchpress ..... 186
Mechanical Press ..... 200
Tube Bender ..... 209

### WELDING AND HEAT-TREATING

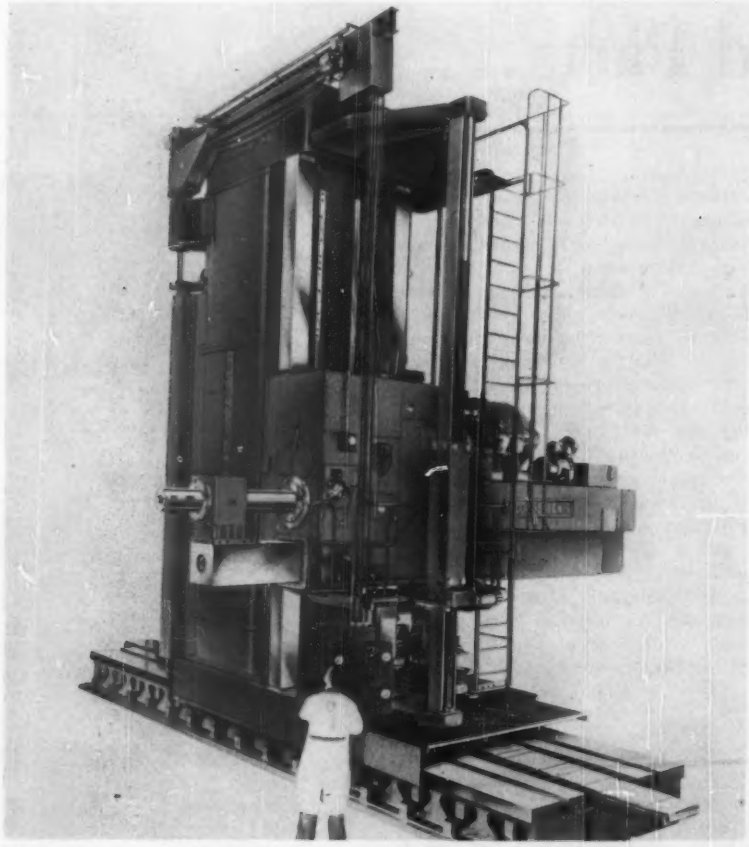
General-Purpose Electrode ..... 174
Welding Process ..... 175
Twin Hearth Furnace ..... 178
Welding Positioner ..... 192

### INSPECTION

Gage Blocks ..... 176
Clinometer ..... 188
Sonic Analyzer ..... 190

### PLANT SERVICE EQUIPMENT

Modular Cabinets ..... 192
Lift Truck ..... 202



## G & L Machine Bores, Drills, And Mills Large, Heavy Workpieces

Giddings & Lewis Model 1210-FUAR floor-type horizontal boring, drilling, and milling machine, said to be world's largest, was recently delivered to an eastern steel company. Machine has 10-in.-dia spindle and an 18-in.-square underarm support. Available with either 10-, 12- or 14-in.-dia spindle and powered by a 100- or 150-hp main drive motor, machine can be furnished with vertical headstock and horizontal column travel to any desired specification.

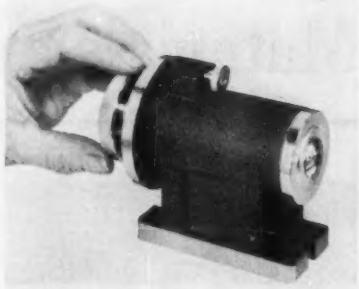
Unit has over-all spindle speed range of 1.56 to 400 rpm through four back gears and a 4:1 adjustable-speed motor. Infinitely adjustable speed ranges of 0.002 to 0.5 ipm and 0.5 to 120 ipm are provided for feed and traverse to spindle and underarm. Milling feeds to column and headstock range from 0.5 to 120 ipm. Electro-hydraulic clamps assure positive locking of headstock to column ways.

Underarm makes possible the mounting of such accessories as a 2-ton 90° angular milling attachment and anti-friction spindle support. Underarm obtains its power from spindle speed mechanism. Lubrication is automatic. Other features include non-metallic liners on headstock and column base, telescopic sights for headstock, underarm, and column travel, independent control of headstock and column, hydraulic clamping, and a load meter mounted on the headstock.

*Giddings & Lewis Machine Tool Co, Fond du Lac, Wis*

**General-purpose E-6013 electrode,** Airco 90B, is a heavily coated electrode of moderate arc force designed to operate in all positions on ac or dc. Said to be particularly useful for welding mild steel to medium carbon and low-alloy steels, electrode is recommended for general use.

*Air Reduction Sales Co, 150 E 42nd St, New York 17, NY*

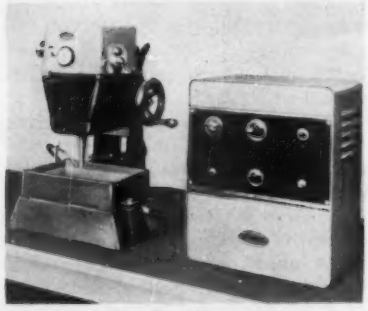


### Woodlawn Indexing Head Weighs Only 6 lb, Uses Standard Collets

Woodlawn indexing head uses standard 3C collets and can be supplied with a 48 or 40-hole index plate. Unit has a 2.500-in. center distance and is mounted on a 2 x 4-in. base. Rotary action can be locked in any position; scale is graduated in degrees (8° each side of index point).

Complete package, consisting of index head, mahogany case, and set of seven collets (⅛ through ½ in.), costs $110. Price of index head alone is $69.50.

*Woodlawn Engineering Co, Inc, 2200 N Mannheim Rd, Melrose Park, Ill*

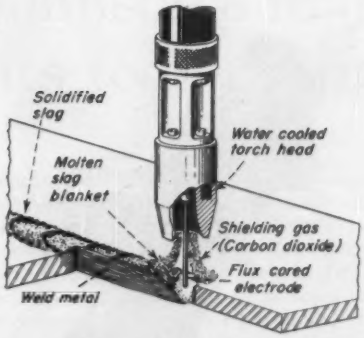


### Ultrasonic Impact Grinder Drills, Slices, Trepans

Lowcost unit uses ultrasonic energy to drill, slice, trepan, engrave and shape hard and brittle materials with tolerances to ±0.0007 in. and finish to 8 mu-in. Machinable areas cover a range from 0.002 to 1-in. dia. Tool will handle hard and soft steels, titanium carbide, tungsten carbide, ceramics and glass.

Construction features include hardened and ground steel ways, steel-encased driver cabinet. Power source is 115 v ac. Bench mounted, pedestal and driver unit is 23 x 16 x 15 and the driver 19 x 16 x 13. Weight is under 200 lb.

*Commercial Equipment Div, Raytheon Mfg Co, 100 River St, Waltham 54, Mass*




## Dual Shield Welding Process Uses $CO_2$ and Flux-Cored Electrode

National Cylinder Gas Co's new Dual Shield welding process combines a flux-cored electrode and shielding gas to achieve low-cost welding of mild steel at a high rate of deposition and travel speed with high penetration. The flux additive, contained in granulated form in the core of the wire, includes an ionizer to stabilize the electric arc, deoxidizer to permit welding mill-run steel without removal of scale and other foreign matter, and a slag forming agent.

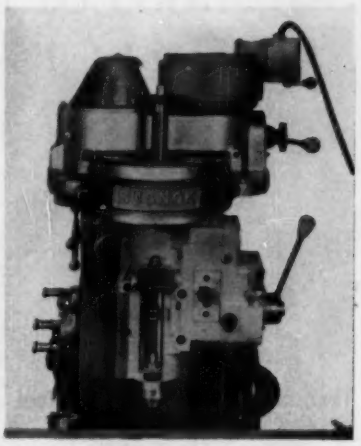
Combination of flux-core electrode and $CO_2$ shielding gas reportedly produces a stable arc resulting in well-shaped weld beads with deep penetration and practically no spatter. Dual Shield process arc is a minimum of 1000 F hotter than the average 9000 F welding arc and is said to produce a weld of 40% deeper penetration than manual processes; it welds the full thickness of a ½-in.-thick solid steel plate in a single pass. Gun weighs only 1½ lb. There is no flux hopper to be refilled.

Equipment includes flux-core electrode in sizes from 1/16 to 3/16 in. in dia, type SA welding control and wire drive unit, and a type SA welding gun. Operator makes preliminary adjustments for wire feed rate, $CO_2$ flow, and voltage output, and inches about ½ in. of wire from gun nozzle. Then, with electrode near, but not touching the work the operator pulls trigger on gun and touches electrode to workpiece. Arc strikes and wire feed starts automatically.

Single pass welds exhibit tensile strengths of 74,000 psi, yield strengths of 61,000 psi, an elongation (2 in.) of 26.5%, and a 59% reduction in area. Using a 3/32-in. electrode and semi-automatic equipment an operator can deposit 14½ lb of weld metal per hr.

Scaly, oily, or rusty steel is cleaned as it is welded and the slag shield peels off as it cools. The deposited weld is said to be low in hydrogen.

*National Cylinder Gas Co, 480 N Michigan Ave, Chicago 11, Ill*

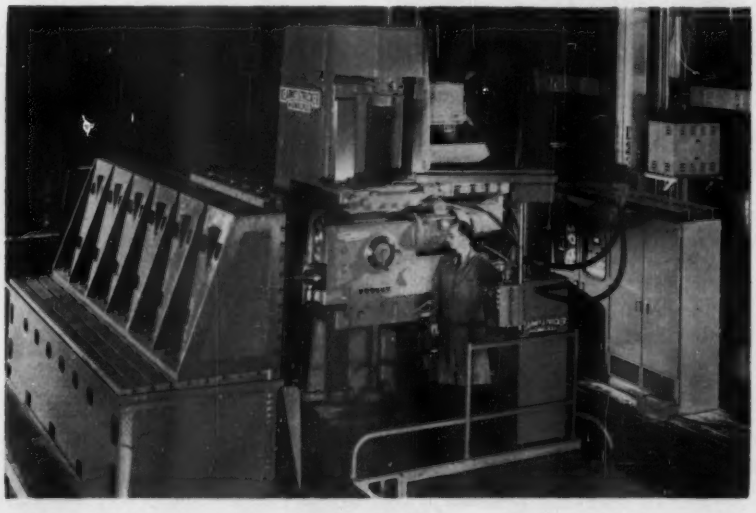


## Mill Head Features Infinitely Adjustable Speed and Feed

Rusnok 120 mill head, designed for milling, drilling, and boring operations at any angle, offers infinitely adjustable spindle speed of 100 to 3600 rpm in two ranges, 100 to 600 and 600 to 3600 rpm with only one belt change. Power feed is infinitely adjustable from 0 to 0.012 ipr both up and down.

Feed rate can be selected with machine running or standing still, and can be disengaged automatically or by hand. Micrometer nut is power feed kickoff; on reverse feed, safety kicks off at end of stroke. Unit has quill travel of 5 in.

*Rusnok Tool Works, 4840 W North Ave, Chicago 39, Ill*



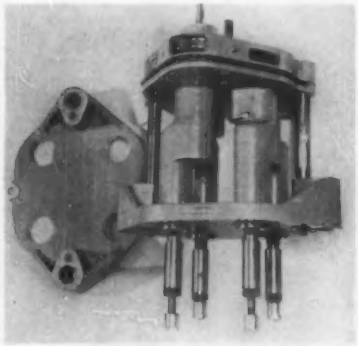
NUMERICALLY CONTROLLED PROFILE MILLER can be used for milling high tensile steel as well as aluminum. Feed rates are from 0.020 to 100 ipm; spindle is powered by 20-hp motor and has a range of 36 to 1800 rpm. Machine operates from digital information punched on plastic tape; motion control unit was developed and built by Bendix Aviation Corp. Machine is first of 22 of this type being produced under Air Force tool modernization program—*Kearney & Trecker Corp, 6784 W National Ave, Milwaukee, Wis* *(details on p166)*

## Electric Clutch Synchronizes Any Number of Presses

Originally designed for flying cutoff operations, Benchmaster's fully electric clutch permits any number of presses to be tripped to synchronize in any desired pattern, although operating completely independent of one another. No mechanical connection exists between presses. Individual timing impulses to each press can be supplied by cam, tape, electronically or by other means.

Time lag between tripping and start of stroke is said to be eliminated, and flywheel can be engaged anywhere in its 360° rotation. Clutch disengages instantly at any desired position of stroke or cycle. If power fails, clutch is automatically disengaged. A variety of controls are available allowing a choice of single-stroke operation, continuous operation, or automatic cycling.

*Benchmaster Mfg Co, 1835 W Rosecrans Ave, Gardena, Calif*

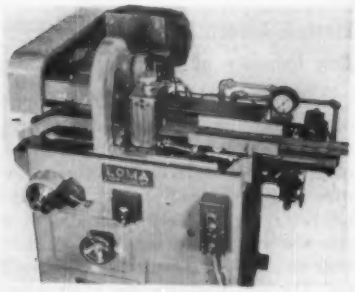


## Thriftmaster Unit Has Individual Leadscrew Tapping Spindles

Multiple leadscrew tapping of several parts with similar but varied hole patterns can be done with new adjustable multiple-spindle head. Company's double-eccentric adjustable drillheads are fitted with leadscrew spindles to make up this head. Bronze leadscrew nuts built into the spindle brackets permit use of ordinary templets to provide a quick means of accurately locating and locking spindles in position. Bronzed bushed lugs register with guide rods in fixture.

Normal spindle travel of 1½ in. is controlled by rotary limit switch operated through special shaft in head.

*Thriftmaster Products Corp, 1016A N Plum St, Lancaster, Penna*



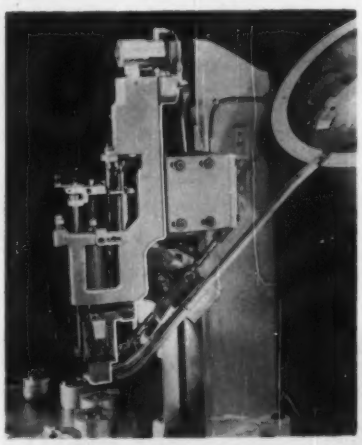

## Circular Cutoff Saw Cuts Non-Ferrous Tubes and Rods

Loma circular cutoff saw cuts to length non-ferrous tubes and rods from ¼ to 4 in. in dia. Outstanding feature of unit is its swinging-arm design that causes an oscillating movement of the sawblade. This action greatly facilitates multiple strand sawing, and as many as ten tubes or rods can be cut simultaneously on the machine.

Up-and-down movement of the saw arm is effected by a combination oil-air system of cylinders. During feed stroke, oil is forced out of hydraulic cylinder, at rate controlled by adjustable flow valve. Thus, feed rate can be selected to obtain optimum cutting conditions.

As soon as stock has been advanced to cutting position, air-operated clamping mechanism moves vertically downwards, holding material on either side of blade. This double stock clamp is said to enable saw to produce cuts practically free of burrs. Entire sawing cycle—stock advance, clamping, saw feed, saw return, clamp release, and stock discharge—is automatically controlled and interlocked. Unit will handle cutoff lengths up to 12 in.; sawblade has peripheral speed of about 10,000 fpm.

*Loma Machine Mfg Co, Inc, 11½ E 32nd St, New York 16, NY*

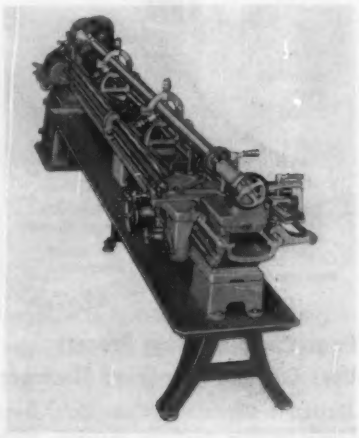


## Parts Positioner Operates at Rates up to 7200 Pieces per Hr

Dixon standardized parts positioner, Model PR-3, capable of accurately guiding a wide variety of piece parts automatically from feeder track to fixture, is a self-contained unit which handles parts ranging from 1/16 to 3-in. OD at rates up to 7200 per hr. Outside dimensions are 21 in. high x 3 in. wide x 5 in. deep.

Positioners are available with strokes of 1, 2, 3, or 4 in. with variable speeds up to ½ sec per cycle. Normal air operating pressure is 80 psi. Unit may be nested on 3-in.-min centers along an in-line transfer table or may be located at adjacent stations on a 5-in.-radius dial-indexing table having as many as 12 stations.

*Dixon Automatic Tool, Inc, 2300 23rd Ave, Rockford, Ill*



## South Bend Lathe Machines Tubing, Shafting, and Other Long Work

Designed for machining tubing, shafting, and other long work, this new 16-in. x 14-ft lathe takes up to 129 in. between centers. Swing over cross-slide is 9⅝ in. (11⅛ in. without chip guard) and max capacity over bed ways is 16¼-in. dia.

With 16-speed drive the spindle speeds range from 15 to 980 rpm. Spindle hole takes work up to 1⅜ in. and max collet capacity is 1 in. Spindle can be supplied with threaded, cam-lock, or long taper-key drive nose. Quick change box provides 48 thread-cutting feeds, 48 power longitudinal carriage feeds, and 48 power cross-feeds.

Accessories include pipe centers, steady rest, follower rest, taper attachment, grinding attachments, collets, coolant units, turret tool block, bar feed, and complete line of chucks and tools.

*South Bend Lathe Works, South Bend 22, Ind*

## Lowcost Gage Blocks Are Designed For Everyday Shop Measurements

Shop-Blocks are manufactured to NBS specifications for "A" grade gage blocks but are said to be less expensive than many lower-grade blocks. They are accurate to +0.000006 in. and −0.000002 in. from marked size. Flatness and parallelism is held within 0.00004 in.; surface finish is 0.8 (arithmetical avg).

Set 860, priced at $265, contains 84 blocks ranging from 0.050 to 4 in. Set 380, priced at $130, contains 36 blocks. Wear blocks are available for either set in sizes of 0.050 or 0.100 in. in tungsten carbide or steel.

*DoAll Co, Des Plaines, Ill.*

# Johnson's major contribution to coolants fits today's high-speed production needs!

Coolants were just coolants for 50 years until Johnson's Wax Research developed formulations using *waxes* and *wax-type synthetics*. Johnson's Metalworking Fluids are as modern and efficient as your 1957 machine tools. They give you superior performance even on your toughest jobs — because Johnson's lubricates and cools under conditions where ordinary coolants fail because of extreme heat and pressure.

Use Johnson's on your fastest machines, with your hardest-to-machine metals, and compare results obtained with conventional coolants. In hundreds of shops across the country, Johnson's coolants for machining, cutting and grinding are reducing costs and increasing profits.

Your local Johnson's industrial distributor will be glad to set up an in-your-shop test of TL-131 — or any of the complete line of Johnson's Metalworking Fluids. Ask him about Johnson's money-back *Guarantee of Superior Performance* over ordinary coolants.

*from*
*Johnson's Wax Research*

**S. C. Johnson & Son, Inc.,** Industrial Products Division, Dept. D-57, Racine, Wisconsin

"Johnson's" is a trademark of S. C. Johnson & Son, Inc.

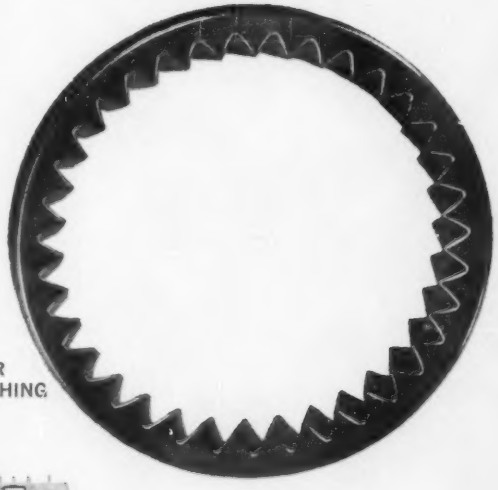
*Pictured below is Johnson's TL-131, one of a complete line of modern coolants for today's high-speed grinding.*

OSBORN BRUSHING METHODS worthy of your confidence

# Automated finishing geared to your production

*...at rates up to 300 pieces per hour*

BEFORE BRUSHING



AFTER BRUSHING

THE automotive pump gears shown above are typical of a wide range of parts that can be precision finished with Osborn's line-production method.

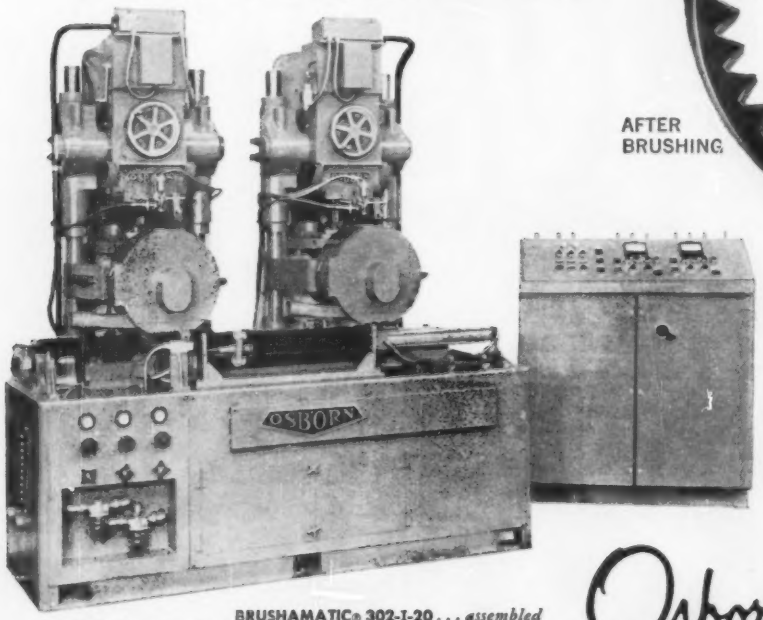
**COMPLETELY INTEGRATED** . . . Osborn's Automated Brushamatic® Equipment fits right into your production line.

**ELIMINATES BOTTLENECKS** . . . It is now possible to remove burrs, blend surface junctures, remove scale, clean parts on a continuous line-production basis.

**AUTOMATES FINISHING OPERATIONS** . . . Takes parts right from your production lines, feeds them to rotating power brushes, delivers them precision-finished to micro-tolerances where necessary.

. . . *all without manual handling*

Automated power brushing is just one example of the many ways Osborn is helping to improve production techniques. An **O**sborn **B**rushing **A**nalysis, made in your plant without obligation, may point out important benefits to your company. Write *The Osborn Manufacturing Company, Dept. C-57, Cleveland 14, Ohio.*




**BRUSHAMATIC® 302-I-20** . . . *assembled from standard Brushamatic components which have been used in various combinations to fill a wide range of finishing requirements.*

Send TODAY for the new 20-page Brushamatic Booklet

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY PRODUCTION MACHINERY

# FYI

## FOR YOUR INFORMATION

### *FREE Catalogs, Booklets, Charts, Calculators*

**FYI**—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

### MACHINES AND ATTACHMENTS

● PRECISION LATHE — *Monarch Machine Tool Co, Sidney, Ohio.* 20-page bulletin 504 contains detailed description of new Series EE Model 1000 with infinitely adjustable spindle speeds up to 2000 rpm, built-in constant surface cutting speed control, and electrical speed changing by single selector knob. Design features illustrated, as well as wide range of optional equipment. Request direct on company letterhead.

**1** HONING HANDBOOK — *Barnes Drill Co, Rockford, Ill.* 44-page catalog 5504 illustrates and describes BarnesdriL machines including design features and specifications, advantages of process, and results. Tables and charts indicate proper speed selection to obtain desired finishes in various materials. Requirements for various applications discussed; abrasive grades and grits, various types of cutting fluids covered.

**2** CHICAGO PRESS BRAKES—*Dreis & Krump Manufacturing Co, 7400 S Loomis Blvd, Chicago 36, Ill.* 16-page catalog AL-57 presents illustrated description of Series A, B, C, and L units. Construction features and specifications given for different sizes of brakes in 30, 36, 50, and 60-ton capacities. Data included on induction hardened dies, special and standard, for all makes of brakes.

**3** VERTICAL ELECTROSPARK MACHINE—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* Bulletin 43373 describes application of Method X process to new Style 243-6 unit. Detailed explanation of process given, as well as working description, floor plan, and specifications of machine that will pierce, drill, tap, trepan, or sink a cavity into any material that is an electrical conductor.

**4** SLITTERS AND SHEAR—*E W Bliss Co, Canton 10, Ohio.* 12-page catalog 56-B, Section 1, covers line of single, gang, and automatic duplex slitters as well as scroll shear for medium and high-speed can making lines. Body blank stacker, motor-driven grinding attachment, and line of slitter accessories also illustrated and described.

### TOOLS AND ACCESSORIES

**5** OPTICAL TOOLING EQUIPMENT —*Keuffel & Esser Co, Hoboken, NJ.* 17-page illustrated catalog gives details on complete line of standard items such as jig transits, alignment telescopes, Paragon tilting levels. Accessories, instrument stands, fixtures, collimators, scales, targets, and attachments, including optical square, are covered.

**6** SINGLE POINT TOOLS—*Viking Tool Co, 1000 Nichols Rd, PO Box 471, Shelton, Conn.* 23-page illustrated catalog 571 describes three separate lines of single point lathe tools, two for throwaway inserts, a third for extra heavy duty regrindable inserts. Cutting materials available include carbides, high-speed steels, oxides, and ceramics.

**7** COMPARATORS—*Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 20-page circular 601 illustrates and describes Electrolimit external and internal types; principle, operation, applications discussed. Also covered are a height gage, snap gages, and comparators for special application.

**8** END MILL SPEED SELECTOR CHART—*DoAll Co, Des Plaines, Ill.* Wall chart lists recommended surface speeds in fpm for most metals and translates these figures into rpm's for end mills of diameters from 1/16 to 2½ in.

**9** COLLETS AND FEEDERS—*Sutton Tool Co, Sturgis, Mich.* 24-page catalog 22 gives illustrated descriptions of standard and master units. Price lists, ordering intructions, cross-section views given for each model.

**10** OPTICAL HEIGHT GAGE—*Webber Gage Co, 12912 Triskett Rd, Cleveland 11, Ohio.* 6-page illustrated folder contains information on Micro-Accurate instrument that measures heights up to 61 in. with accuracies of ± 0.000005 in. per inch of height. Unit combines Webber gage blocks and Leitz measuring microscope.

**11** BRINELL HARDNESS TESTING MACHINE — *Gries Industries, Inc,*

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# FYI
FOR YOUR INFORMATION

*Testing Machines Division, New Rochelle 6, NY.* Illustrated bulletin A-15 covers motorized machine for rapid production Brinell testing, based upon the diameters of the ball impressions. Functions and applications described.

**12** "CARE OF DRILLS AND REAMERS"—*Chicago-Latrobe, 411 W Ontario St, Chicago 10, Ill.* 22-page booklet illustrated with graphs and charts contains technical data on use, sharpening, and handling of drills and reamers made of high-speed or carbide steel.

**13** ELECTRICAL AND PYROMETER CONTROLS—*Tipptronic, Inc, Fourth & Franklin Sts, Tipp City, Ohio.* 16-page catalog AC-2 illustrates and describes automatic, package controls for any application where a chemical or mechanical function can be measured electrically. Self-contained controls are available with shut-off, sampling, cycling, and pulsing action.

**14** COLLETS—*Balas Collet Manufacturing Co, 1550 E 27th St, Cleveland 14, Ohio.* Beneo catalog 57 illustrates and describes collets, pushers, feed fingers and pads for all types of screw machines, as well as lathe collets.

## HEAT TREATING AND WELDING

**15** HEAT-TREATING EQUIPMENT—*C I Hayes, Inc, 500 Wellington Ave, Cranston 10, RI.* 12-page illustrated bulletin 461 discusses design advantages and available sizes of line of hardening, preheat, high-speed steel, tempering, and vertical furnaces.

**16** INDUCTION HEATING EQUIPMENT—*Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Penna.* 8-page bulletin DB 28-750 illustrates and describes motor-generator sets and accessories. Covers construction, operation, and application of high-frequency sets. M-g set cooling systems explained.

**17** WELDING POSITIONERS — *Aronson Machine Co, Arcade, NY.* 8-page bulletin 8U57 contains information on and pictures of variety of small units from 75 to 500-lb capacity. Applications, specifications, optional accessories included.

## PARTS AND MATERIALS

ELECTROMAGNETIC CONTROL EQUIPMENT — *Automatic Switch Co, 5056 Hanover Rd, Florham Park, NJ.* 174-page illustrated catalog 57-S combines information on six individual catalogs covering automatic transfer switches; remote control switches; magnetically held contactors; relays; ac and dc solenoids; electric plant controls. Data provided includes electrical specifications, constructional and operational information, dimensions and weights, standard and special features, detailed index. Request direct on company letterhead.

**18** WORM GEAR DRIVES—*Cleveland Worm & Gear Co, 3249 E 80th St, Cleveland 4, Ohio.* 16-page illustrated brochure 145 contains condensed data on complete standard line of speed reducers, worm gear sets, and special units.

**19** TOOLING FOR POWDER METALLURGY—*Vanadium-Alloys Steel Co, Latrobe, Penna.* Folder outlines characteristics of various grades of tool steels for punches and dies for forming parts from metal powder. Separate data sheets enclosed describe variety of high-speed steels and die steels for cold work; information provided on composition, heat treatment, and applications.

**20** RESISTORS—*General Electric Co, Schenectady 5, NY.* 36-page illustrated bulletin GEA-6592 covers complete line of vitreous enameled stock resistors, both fixed and slide-wire, ranging from 5 to 200 w, and high-capacity units rated up to 1200 w. Selection and ordering information, ratings, and technical data included.

**21** CARBON-GRAPHITE BEARINGS —*Electro-Nite Carbon Co, 3601 Torresdale Ave, Philadelphia 36, Penna.* 12-page illustrated catalog gives details on non-lubricated bearings for operation under very high temperatures. Properties, load rating charts, standard grade and application data sheets included.

**22** MACHINING STAINLESS STEELS —*Carpenter Steel Co, Reading, Penna.* Pocket-size slide chart gives data on turning, drilling, tapping, threading, milling, and reaming. Speeds and feeds tabulated; notes on drilling, tapping, lubrication, and welding provided. Relative workability of stainless steels shown in variety of operations.

**23** CYLINDERS—*Logansport Machine Co, Logansport, Ind.* Illustrated data sheets provide dimension and engineering details on Logansquare cylinders for air or oil service. Sizes range from 1¼ to 8-in. bores; operating pressures are 150 psi air, or 300 psi oil.

**24** STAINLESS STEEL FASTENERS —*Star Stainless Screw Co, 655 Union Blvd, Paterson 2, NJ.* 24-page catalog 56-A illustrates and describes complete line, including new items such as hinges and screw machine products. Corrosion resistance tables, standard specifications for various types of stainless, AN specifications, table of decimal equivalents included.

**25** V-BELT MAINTENANCE — *Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.* 12-page bulletin 20X6234C discusses eight most common causes of destruction, lists steps for correct installation, offers suggestions for making belts last longer. Describes various types of V-belts, tells how to select and match them.

**26** STAINLESS STEEL BAR AND WIRE — *Armco Steel Corp, 4758 Curtis St, Middletown, Ohio.* 24-page booklet describes 45 types available in these forms, including several special proprietary grades. Typical applications illustrated. Advantages, properties, fabrication, electropolishing, ebonizing, and supply information included.

**27** RIGHT ANGLE BEVEL GEARS— *Airborne Accessories Corp, 1414 Chestnut Ave, Hillside 5, NJ.* 4-page illustrated bulletin 57 contains data on ANGLgear standardized units. Line drawings give dimensions of three sizes: 5, 1, and 1/3 hp, all available as 2-way or 3-way types and with 2:1 or 1:1 shaft ratios. Table of basic data lists rated hp and speed for all 12 standard models, gives static torque from output shaft, shaft diameter and weight.

# Watchdog on mounting costs

PRICES of common materials keep going up. Many new alloys are costly. Hence, rough castings become more expensive.

Even more, the cost of machining time keeps mounting. No one can afford to have it wasted by waiting for the tool to locate a void or defect.

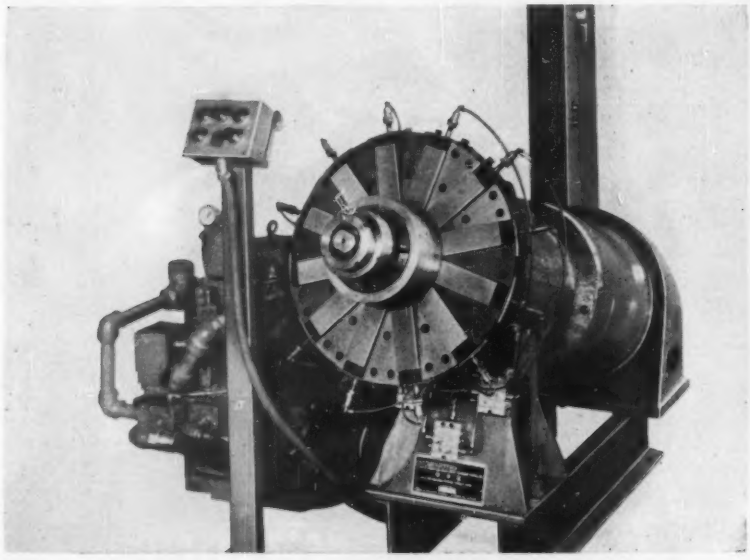
So now is a good time to re-examine the importance of radiography. To suppliers it gives the assurance that only a quality product is delivered. To processors it gives the confidence that man and machine time will be productive—not wasted.

Today, million-volt x-ray equipment radiographs heavier parts with shorter exposures. The use of radioactive isotopes makes possible a radiographic department at moderate cost. And the new Kodak Industrial X-ray Film Type AA—with up to twice the speed of the previous film—widens the scope of all radiographic equipment.

If you would like to know how radiography can save you money—how it can keep the quality of castings high—have a serious talk with your Kodak x-ray dealer or Kodak technical representative.

**EASTMAN KODAK COMPANY**
**X-ray Division, Rochester 4, N. Y.**

Kodak
TRADE MARK



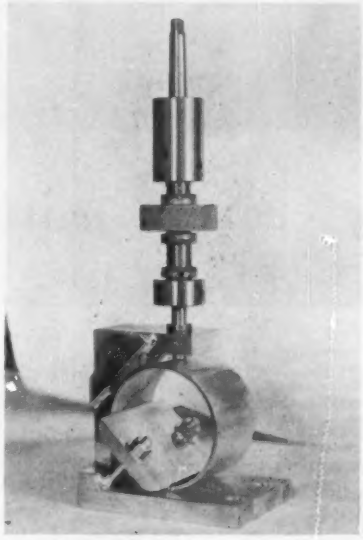
## Grotnes Expander Has Peak Drawbar Pull of 215 Tons

Grotnes 15-H-215 Expander, first in new H series, has a peak drawbar pull of 215 tons at the max hydraulic system pressure of 3000 psi. The new line will have capacities ranging from 60 to 1450-tons drawbar pull. A wide range of shapes and sizes of parts can be handled in one basic machine by interchanging the draw bar, cone, jaws, and table. The principal application of the machines is in the forming and sizing of cylindrical, conical, and polygonal sheet metal and tubular parts. Accuracy up to 0.004 in. TIR can be readily obtained.

Piston and piston rod are integral. Downstroke is stopped when a special nut threaded to top of rod reaches a shoulder machined in the extended neck of the hydraulic cylinder head, causing theoretically opposite and equal forces to be imposed on the head. This permits lighter, yet stronger, cylinder construction. Duplex variable-delivery pump, reservoir, oil cooler, piping, and valves comprise the hydraulic system which is capable of operating the machine at from two to six complete cycles per min.

Jaw-cone and jaw-table contact surfaces are automatically force lubricated. Jaw dia is infinitely adjustable within its dia range. With the unit illustrated, 2½ sq in. of stainless steel having a yield strength of 100,000 psi can be expanded.

*Grotnes Machine Works, Inc, 5454 N Wolcott Ave, Chicago 40, Ill*

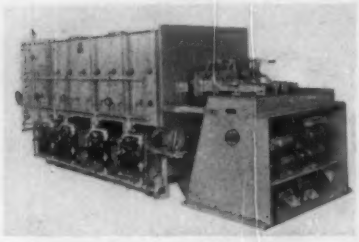


## Chamfering and Deburring Tool Processes Circular Surfaces

Tool for use in radial or drillpress chamfers and deburrs holes in walls of tubing or pipe. Device produces holes from ⅜ in. in dia to 3 in. inclusive in round parts with diameters from 1 in. on up to any size, as many holes as may be required.

Any width of chamfer reportedly can be produced, from 0.005 up, with any degree of angle, form, or radius; also a true concave or convex surface inside the hole. Burrs can be removed from inside and outside of any hole, and any shape in the hole can be produced, in one operation. Tool can be used on any type of machinable alloy, with as low as a 20 micro finish, according to manufacturer.

*Falcon Tool Co, Ryan Rd, Detroit 24, Mich*

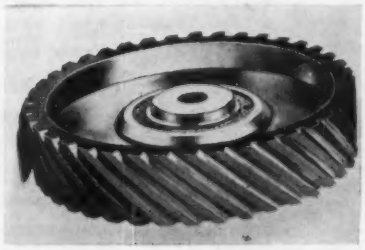


## Twin Hearth Furnace Adaptable To Production Line Installation

Two parallel sealed hearths are mounted in Model 242 shaker furnace to double the heat treating production of the same work or to heat treat two different types of parts which require the same atmosphere for processing at the same or different time cycles.

Automatically operated hearths are each intended to process up to 800 lb of work per hr. Each is individually controlled for operating speed. Work advances automatically by regularly interrupted reciprocating movement that carries it through the controlled atmosphere.

*American Gas Furnace Co, 1006 Lafayette St, Elizabeth, NJ*



**RUBBER CONTACT WHEELS, featuring a tire-flanged total disk assembly, are designed for use in a variety of finishing operations with abrasive belts. Assembly is of welded steel, and wheel has 30% trade-in value when worn. Available in many sizes in plain or serrated faces, and in all hardnesses —*Chicago Rubber Co, 651 Market St, Waukegan, Ill***

# Inland Ledloy*...the original leaded steels

Nearly twenty years ago, Inland started a metalworking revolution with its discovery of how to add lead to steel. The first experimental heat and the first production heat of leaded steels were made in Inland furnaces. Since then, by unending probing, refining, and perfecting, Inland has learned the secrets of making fine leaded steels. Today, Inland, the largest producer of leaded steels, sets the standards with which all other free machining steels are compared.

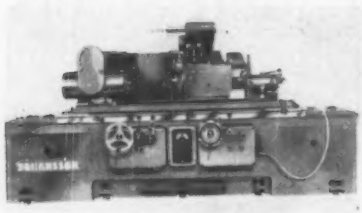
These Inland Quality Control men are checking the results of a "sweat-test." Samples of billets of Ledloy are baked in an electric oven. Then, the minute drops of lead which rise to the surface are checked for uniformity of size and dispersion. Billets that do not meet Inland's rigid standards are rejected. It is one of many controls Inland uses to make certain your Ledloy is the finest leaded steel made.

Because of Inland's long history in making leaded steels, technicians like these know... *by experience*... that your Ledloy will be right. Inland standards, worked out through many years, are your assurance that the Ledloy represented by these samples will be another shipment of the world's most machinable steels.

# Experience makes Inland Ledloy better

*INLAND LEDLOY is sold in cold drawn form, under various trade names, by leading cold drawers and steel warehouses from coast to coast.*

**INLAND STEEL COMPANY** *38 South Dearborn Street • Chicago, Illinois Sales Offices: Chicago, Milwaukee, St. Paul, Davenport, St. Louis, Kansas City, Indianapolis, Detroit, New York • *registered trade name of Inland Steel Company, pioneer in the development of leaded steels.*



## Swedish Precision Grinder Comes in Two Types

Johansson grinder, a product of Sweden, is available in two types: Model 2P for production, and Model 2U for toolroom and production use. Center distances are 40, 60, and 80 in., and swing over table is 14 in. Universal type takes grinding wheels of 20-in. dia and up to 3-in. width; production model takes up to 30-in.-dia wheels and 4-in. width.

Table travel is 236 ipm maximum. Max dia in chuck is 7 in., in collets 1½ in. There are 12 speeds ranging from 20 to 320 rpm. Wheelhead swivels to allow simultaneous diameter and end face grinding by profiled wheels. Headstock is rotatable through 360° and can be used at either right or left hand end of table.

Manual and automatic feeds may be operated simultaneously. For series production, machine can be equipped with an electro-hydraulic attachment that automatically switches from normal rate of feed to fine feed at a predetermined point.

*Homestrand, Inc. 9 Addison St, Larchmont, NY*

## Gages Permit Rapid Measurement Of Small Hole Diameters

Kwik-Chek hole gages have a readability and accuracy of .0005 in., a direct reading scale marked in increments of .001 in., and are equipped with a 2½X magnifying lens. Complete set of three gages covers hole diameters from .025 in. to .380 in., each gage having a range of .125 in.

Needle is released by pushing clutch button; needle is inserted in hole; barrel is pushed down flush with piece being measured; and gage is removed and diameter read directly. Each gage is priced at $40; complete set, in case, costs $115.

*Hamilton Watch Co, Allied Products Div, Lancaster, Penna*

## Speed Reducer Provides Stepless Speeds From 0 to 400 rpm

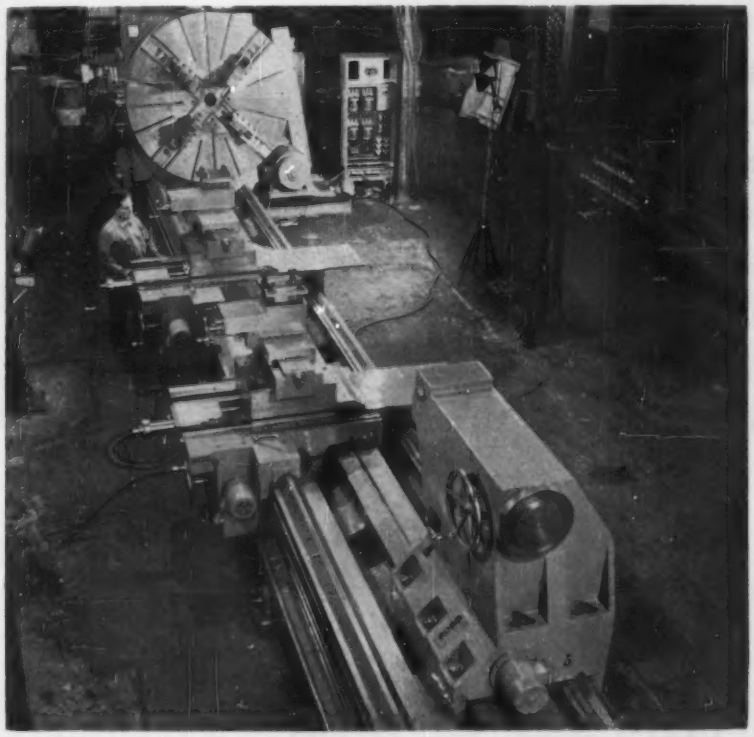
Zero-Max variable speed reducer is a motorized package unit in which the motor drives the Zero-Max through 1:1 helical gears running in oil. Eight basic models delivering 10 to 30-in.-lb torque with CW or CCW output shaft rotation are available.

Instant speed changes can be made with the lever control while unit is running or stopped. Screw control is available for fine speed adjustment. Standard 48-frame motor is 115v, 60c, single phase. Package is only 5¾ in. high x 5⅝ in. wide x 9⅝ in. long (minimum), excluding shafts. Prices start at $65.

*Revco, Inc, 1900 Lyndale Ave S, Minneapolis, Minn*

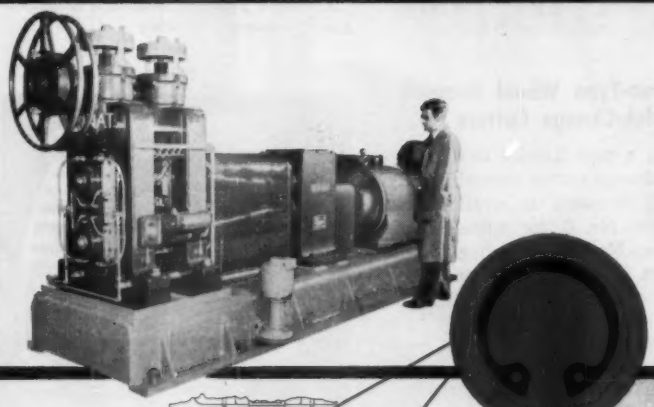
**Magnesium finishing processes,** Turcoat 4245-2F and 4091, are designed to replace Dow No. 17 and 18 processes. Both materials provide corrosion resistance, paint-base qualities, and abrasion resistance to all forms and alloys of magnesium. Bulletin No. 108-16.

*Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif*



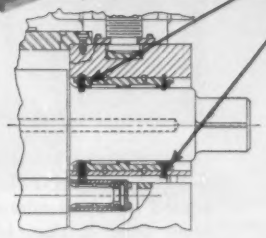
**EXTRA-HEAVY DUTY LATHE is available in two models: Barer-Meuser M VII S has a 48 or 56-in. swing; the M VIII S has a 60, 68, or 78-in. swing. Lathes have center distances up to 40 ft and are available with one or more carriages. Made in West Germany, machines have many features, including headstocks which give 12 low faceplate speeds and 18 high spindle speeds, 6-direction rapid traverse on each carriage, and micromatic carriage stops for both longitudinal and cross feeds. Weight of a 78-in. machine with 40-ft centers is approx 130,000 lb—*Barer Engineering & Machinery Co, Ltd, Champlain, NY***

# 7-inch Waldes Truarc retaining rings cut costs, speed assembly-disassembly of 2-high/4-high mill

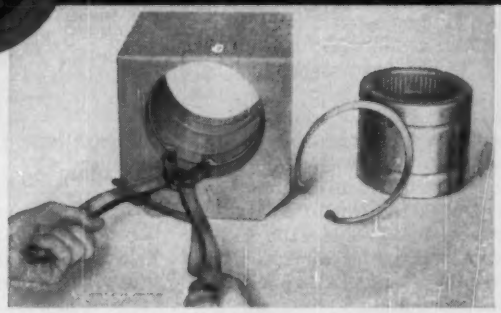


New Model TA-625 2-high/4-high combination rolling mill designed by Stanat Manufacturing Co., Long Island City, N. Y., reduces 2½" ingot to precision-rolled strip as thin as .001".

Waldes Truarc retaining rings help make possible a complete change of work rolls in 20 minutes... solve difficult problems of accuracy control by achieving positive location of bearings to extremely close tolerances. Rings eliminate costly parts and machining, save space, reduce maintenance.



In the assembly illustrated above, 7" Waldes Truarc (Series 5000) retaining rings—three on each roller—are used to position heavy-duty needle bearings in the bearing housing. Smaller rings position bearings in other roller assemblies and retain the shaft of a dual handwheel screwdown. All in all, 18 Waldes Truarc rings are used in the mill. They replace machined shoulders, spacers and lock nuts... eliminate costly threading, other machining operations.



Assembly is simple, even with giant 7" diameter Truarc ring. Special Truarc ratchet pliers grasp the ring securely, ease it into the groove, snap it securely into position. Smaller pliers and various high-speed assembly jigs are available for other rings, permit assembly-disassembly to be performed rapidly even by unskilled labor.

**Whatever you make,** there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. Quick and easy to assemble and disassemble, they do a better job of holding parts together. Truarc rings are precision-engineered and precision-made, quality controlled from raw material to finished ring.

**36 functionally different types**... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U.S.A. and Canada.

**More than 30** engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

**For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!**

**WALDES TRUARC® RETAINING RINGS**

©1956 Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N.Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.
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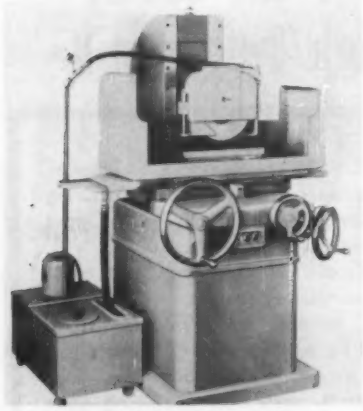
WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

*SEE THE TRUARC EXHIBIT AT THE DESIGN ENGINEERING SHOW, NEW YORK COLISEUM, MAY 20th TO MAY 23rd. BOOTH NO. 1010.*



## Grinder Table Is Actuated By Timing Belt Drive

Covel No. 17 hand feed surface grinder, designed for die block and general toolroom work, has its elevating wheel located below table level so that both point of contact and handwheel graduations are visible at same time. Hard chrome table ways are available.

Table is actuated by a timing belt drive. Only 2¾ turns of a large-dia handwheel moves table the full 16 in. Spindle is grease lubricated and is driven by 2-hp, 1750-rpm motor. Addition of pump and tank unit converts machine into wet grinder. Bulletin 71.

*Covel Mfg Co, Benton Harbor, Mich*

## Huntington-Type Wheel Dressers Have Quick-Change Cutters

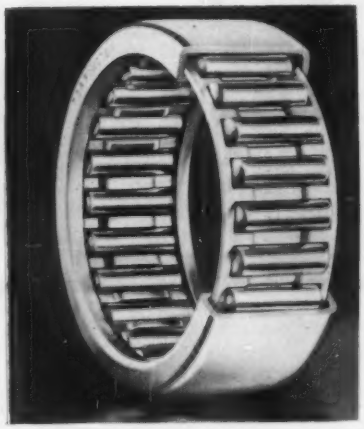
Featuring a new handle design and a quick-change cutter assembly, line of wheel dressers is available in three sizes: No. 0, for wheels up to 10-in. dia; No. 1, for wheels from 10 to 16-in. dia; and No. 2, for wheels 15 in. in dia and over. Cutters are changed by loosening only one screw. Handle holds six sets of bearings. Cutters are made of high carbon steel, and have milled teeth.

*Machine Products Corp, 125 Hollier St, Dayton 3, Ohio*

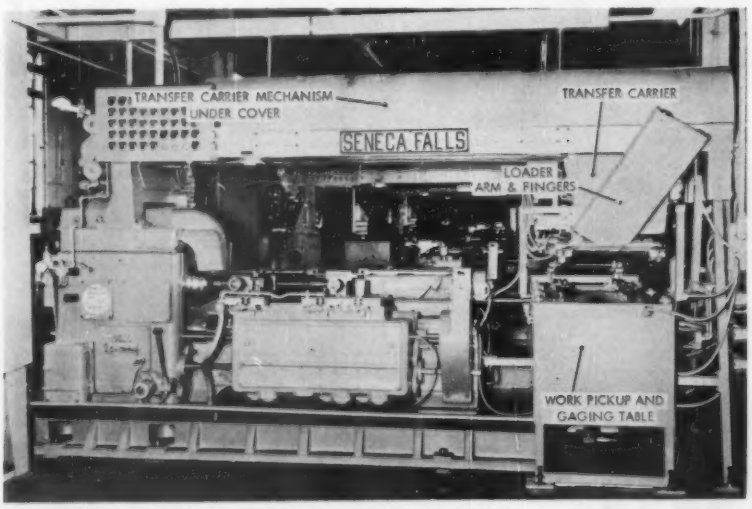
## Erickson Introduces New Line Of Expanding Jaw Mandrels

Designed for gripping and driving bored parts during machining, the Erickson-Nicholson-type expanding jaw mandrels are guaranteed to be concentric within .0015 in. TIR. Type A mandrels are of step-jaw design, come in 5 sizes covering all ID sizes from ½ to 4 in., and accommodate hex as well as round holes. Type B mandrels are of straight-jaw design, come in 14 sizes to take all bores from ½ to 7 in., and can be used in either square or round holes.

*Erickson Tool Co, E 23rd & Hamilton Ave, Cleveland 14, Ohio*



DRAWN-CUP ROLLER BEARING is low-cost, non-separable assembly designed for applications requiring minimum cross section, high speed, and long pre-greased life. They are made in six sizes for 5/16-in.- to 1⅛-in.-shaft diameters. Turned-in lips of bearing cup exclude dirt and grit, and seal in lubricant—*Torrington Co, Torrington, Conn*




REAR AXLE SHAFTS are machined and gaged in setup consisting of four Model AR Automatic Lo-swing lathes, automatic gaging station, work transfer and work loading equipment, conveyor lines, and mechanized chip conveyor. Production on each machine is timed for 180 shafts per hr at 100% efficiency. First machine rough-turns five diameters and chamfers; second rough-faces flange and semi-finish-turns the spline dia; third finish-faces flange, bearing dia and chamfer; fourth finish-turns three diameters—*Seneca Falls Machine Co, Seneca Falls, NY*

## Device Chills Metal Specimens For Impact Testing

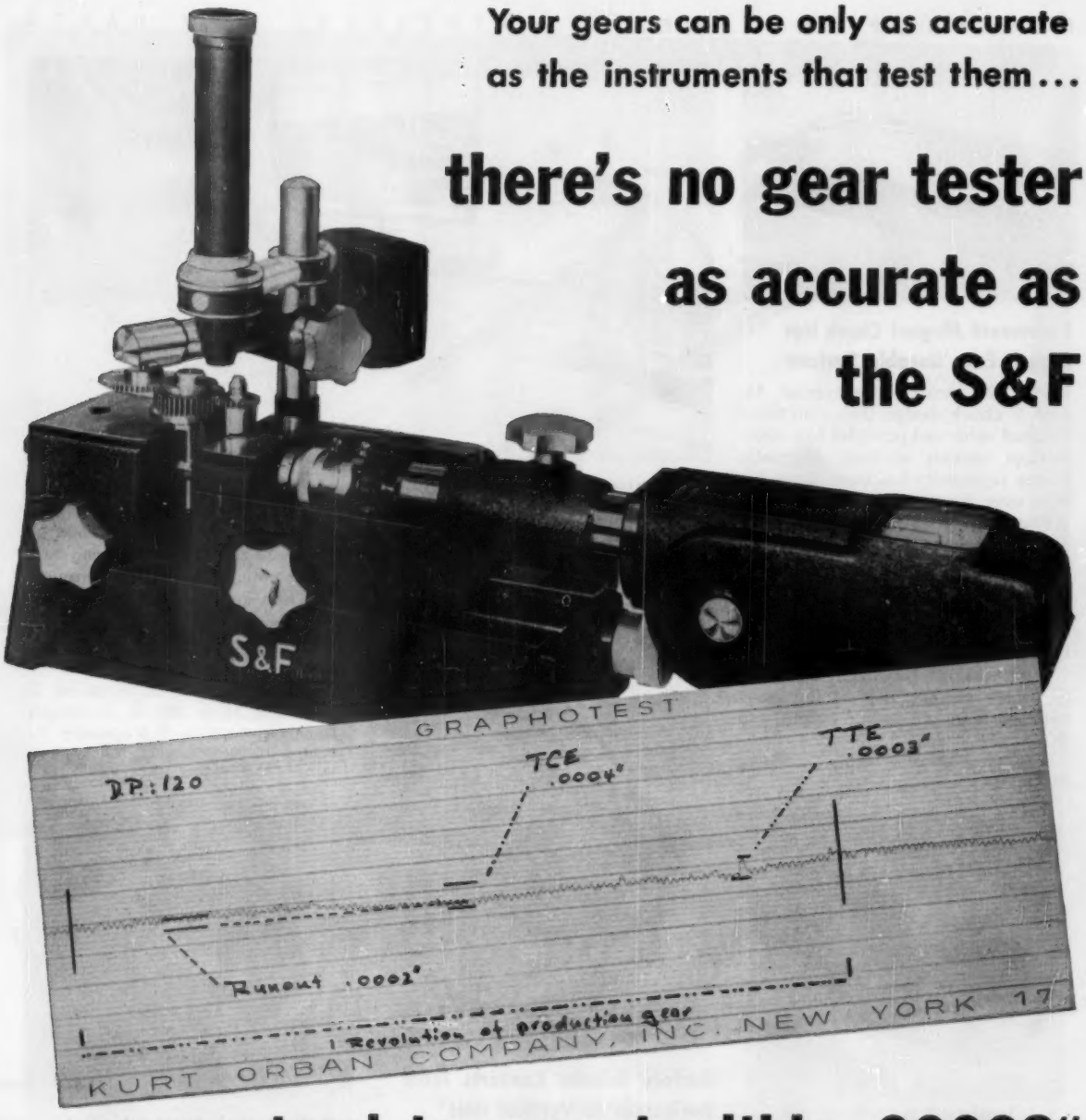
Model LA-120-2 low - temperature chilling machine reportedly permits accurate control of temperatures from + 25 F to – 135 F. Chamber is 24 in. long, 12 in. wide and 12 in. deep, with clear opening at the lid of 21½ x 10½ in.

Thermal capacity is approx 400 Btu per hr at —120 F. The two 230-v 60-c, single phase motors have thermal overload and under-voltage protection.

*Cincinnati Sub-Zero Products, 3930 Reading Rd, Cincinnati 29, Ohio*

**Your gears can be only as accurate as the instruments that test them...**

# there's no gear tester as accurate as the S&F




## ...guaranteed to repeat within .00002"

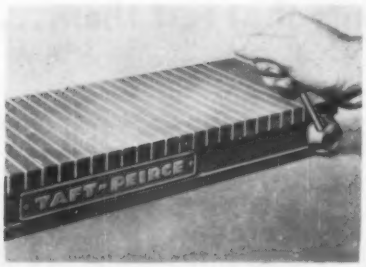
240 are proving it every day in 168 precision plants that took their gear accuracy seriously enough to change over to the S & F Gear Tester—the fully mechanical instrument that is revolutionizing gear checking.

Want us to prove it to you, too? Ask for a demonstration, or the name of the S & F user near you.

KO CO. INC. INDUSTRIAL IMPORTERS

# KURT ORBAN COMPANY, INC.

36 Exchange Place, Jersey City 2, N. J. • In Canada: 2490 Eglinton Ave. W, Toronto



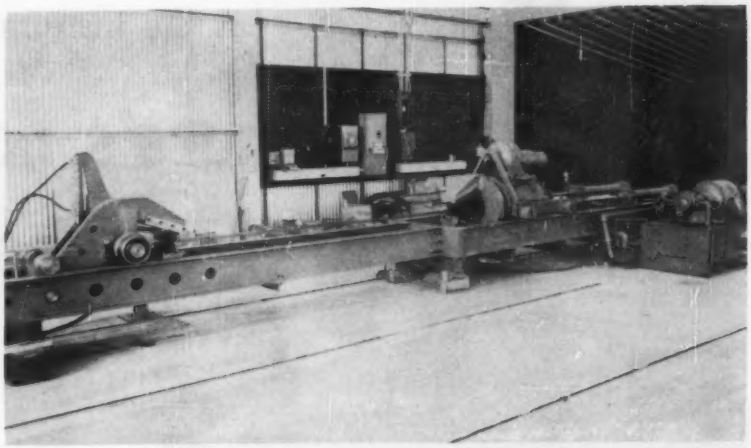

## Permanent Magnet Chuck Has Edge-to-Edge Useable Surface

Model 824 incorporates special Alnico V chuck design that eliminates all dead spots and provides full edge-to-edge useable surface. Magnetic power reportedly has been increased 28% over comparable units.

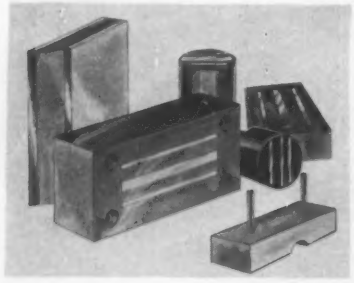
Faceplate uses a special epoxy resin non-magnetic separator material which provides unusual stability, makes chuck 27% lighter. Separators eliminate wheel loading while dressing, and chuck can be used for fine tolerance work.

Specifications are height of 2 7/16 in.; work surface, 8 x 24 in.; magnetic surface, 168 sq in.; weight, 110 lb.

*Taft-Peirce Manufacturing Co, Woonsocket, RI*



ALUMINUM ALLOY EXTRUSIONS are stretch-straightened on this 25 ton machine which can handle any structural shape which has a max cross-sectional dimension of 8 in. Jaws in headstock and tailstock are vertically positioned for fast horizontal material pass line. Headstock can be turned for removing twist while extruded section is being stretched. Automatic zeroing control returns headstock to zero position after detwisting—*Sutton Engineering Co, First National Bank Bldg, Pittsburgh 22, Penna*

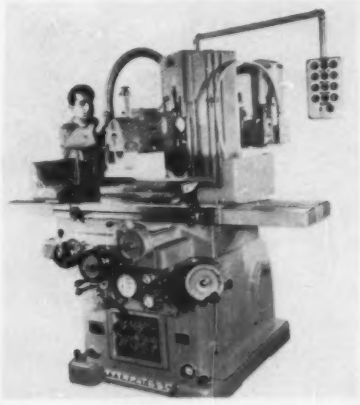


## Ceramic Magnet Assemblies Available in All Sizes and Shapes

Ceramic Indox magnets are attached to steel pole pieces and then molded into an epoxy resin to form these magnetic assemblies which are used for transferring parts, retaining of parts in assembly operations, and other varied uses. Units are available in many shapes and sizes.

Only the contact surfaces of the pole pieces are exposed through the resin. Magnets are said to have max resistance to demagnetizing fields, to recover even when demagnetized to zero flux, and they can be machined for any application.

*Storch Products Co, Inc, 9232 Greenfield, Detroit 28, Mich*



## Surface Grinder Converts From Horizontal to Vertical Unit

Zocca Quick-Change surface grinder, a product of Italy, features a rigid turnabout column, rotating 180°, which makes the vertical and horizontal heads interchangeable. Unit can be adapted to multi-angle grinding by simply mounting a universal head on either side.

Wheelheads have hydraulically driven, infinitely controlled feeds and rapid return. Traverse feed of wheel is automatic when grinding. Down feed of wheelhead is infinitely variable with a range from .0002 to .0025 in. per longitudinal stroke of the table. Table is hydraulically driven by twin cylinders and has speeds from 3 to 100 fpm.

Grinders are available in table sizes ranging from 12 to 48 in. in width, and 24 to 360 in. in length.

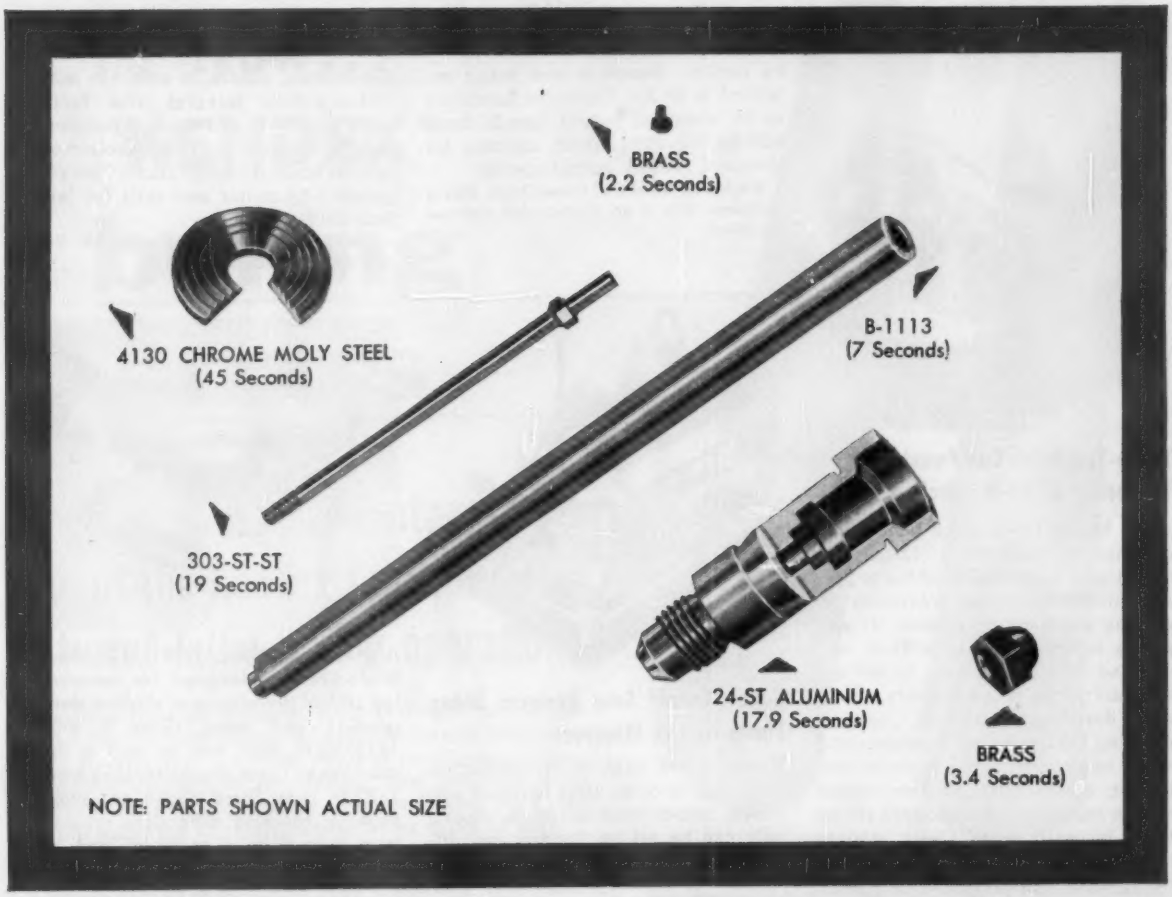
*Imported by S & S Machinery Co, 140 53rd St, Brooklyn 13, NY*

## Standard Gage Blocks Available With "Minus Nothing" Tolerances

New tolerances, plus 8 millionths of an inch, minus nothing, for working accuracy blocks, and plus 4 millionths, minus nothing, for inspection accuracy, are said to mark the first time that standard blocks have been offered with all deviations guaranteed to be on the plus side of the nominal block size.

By eliminating the minus tolerance, gage blocks automatically pick up a guaranteed minimum wear factor equal to the tolerance eliminated, according to the manufacturer.

*Dearborn Gage Co, Ellstrom Standards Div, 22036 Beech St, Dearborn, Mich*




# Save Money On Parts Like These

DETROIT Screw Matic 750

SINGLE SPINDLE BAR AUTOMATIC

## HERE'S HOW:

- 4 to 1 ratio reversing, transmission drive.
- Greater capacity with a 1¾" stroke from a standard 6" cam.
- Reversing clutches that need no adjustment.
- Cam shaft drive clutch with brake to prevent coasting.
- Anti-backlash cam shaft.
- Six spindle speeds in a cycle assuring correct cutting speeds for all tools.

Write for further information on various models available. We will, also, gladly make time cycle estimates for your parts.

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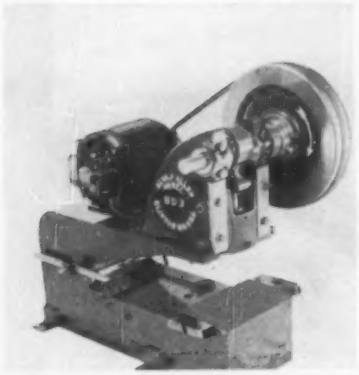
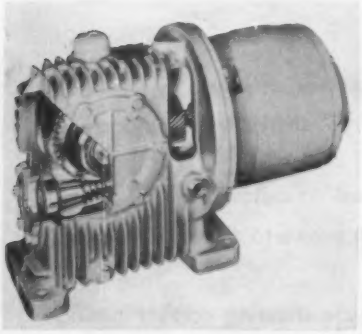
MANUFACTURERS OF: FULLY AUTOMATIC GEAR GRINDING MACHINES
RZEPPA (SHEPPA) CONSTANT VELOCITY UNIVERSAL JOINTS 57-3



## Three-Ton Press Can Punch To Center of 24-in. Circle

Allen Model BD-3, 3-ton bench-type punchpress features a 12-in.-deep throat which enables machine to perform many operations previously requiring much larger presses. It will punch to the center of a 24-in. circle, and will perform up to 300 operations per hr on continuous punching, forming, blanking, cutting, drawing, and shearing in metals and other materials. Press contains single-pin clutch with positive repeat or non-repeat action. Standard stroke is ¾ in. with ¼ to 1½-in. strokes available at additional charge. V-belt drive requires 1/3-hp motor. Complete with foot control, V-belt, motor pulley, and bolster plate, unit costs $274.

*Alva Allen Industries, Clinton, Mo*



## Gearmotor Line Incorporates Double-Enveloping Worm Gearing

New line of right-angle worm gearmotors is furnished in both standard extended shaft and shaft-mounted models. Standard NEMA D-flange motors are used, and gearmotors are available with or without motors as desired.

Four different sizes are currently available to handle fractional to 15-hp motors. Range is now being extended to 40 hp. Units are furnished in 28 standard output speeds from 6.25 to 525 rpm, which includes all standard AGMA output speeds.

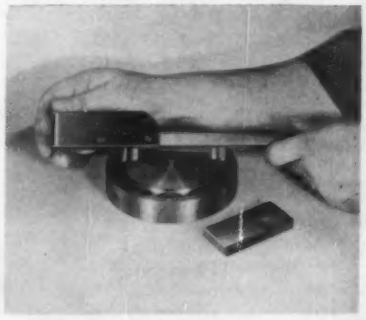
*Michigan Tool Co, Cone-Drive Gears Division, 7171 E McNichols Rd, Detroit 12, Mich*

## Kenco Cutoff Saw Reduces Setup Times to 1½ Minutes

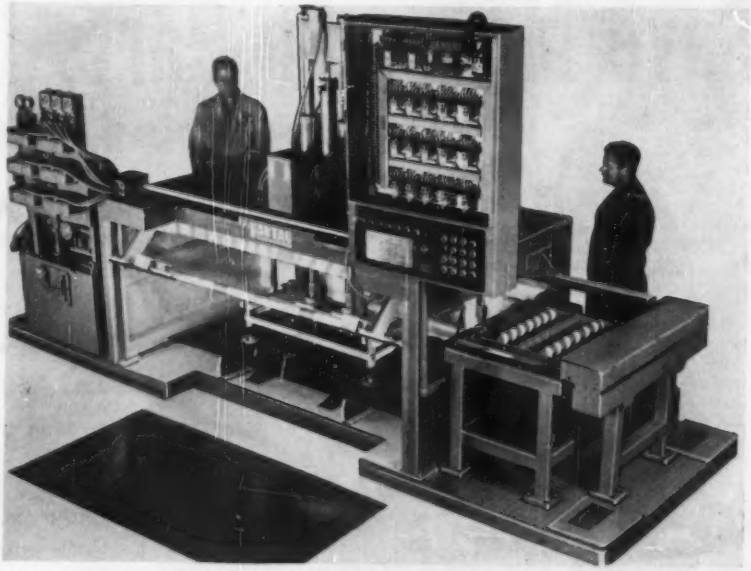
Kenco cutoff saw, with production capacities of ¾-in. steel barstock and 1½-in. non-ferrous barstock, reportedly can be set up for any run, including changeover from ferrous to non-ferrous metals, in only 1½ min.

Heavy-duty integral vise holds work positively and in exact position. Guard offers positive protection against blade disintegration. Unit requires 1-hp motor and sells for less than $300.

*Kenco Mfg Co, 5211 Telegraph Rd, Los Angeles 22, Calif*



ADJUSTABLE INDICATOR GAGE called Shalo-Chek is designed for measuring critical dimensions of shallow slots, grooves, and holes. Gage is only 1-13/16 in. high, can be used at the machine to check depths ranging from 1/32 to ½ in. Three models are available for checking dimensions ranging from ½ to 6 in., 4 to 12 in., and 10 to 18 in.—*Ellstrom, Inc, Dearborn, Mich*



AUTOMATIC SHEET FEEDER AND SCRAP EJECTOR processes blanks successively, from a loaded stack, through oiling rolls, and then through press. It also feeds scrap out of press. Sheets are picked up by vacuum lift and deposited in transfer carriage which feeds sheets through press. Feeder is positioned on rails permitting full access to press for die removal, and is hydraulically powered by two motor-driven pumps—*Hautau Engineering Co, 721 Wanda, Detroit 20, Mich*

# Now... KENDEX* boring bars

## bring all the advantages of the Kendex principle to turret lathe boring operations

Exhaustive tests on different turret lathes** prove that Kendex Boring Bars provide all the benefits and economies of the Kendex principle now enjoyed in turning, facing, and milling operations. In addition, and probably more important in boring operations, Kendex Boring Bars provide the following advantages over other types of bars:

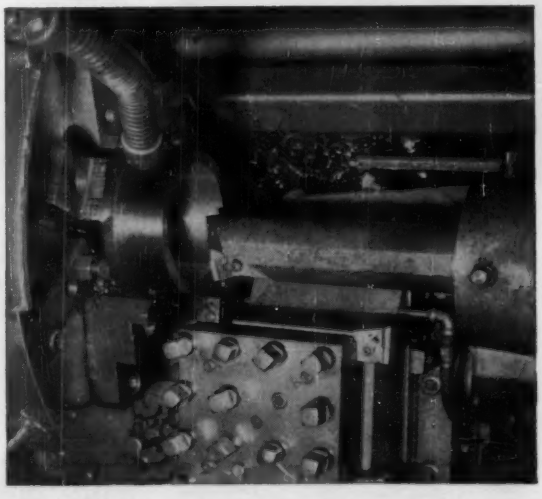
- **the cutting point is brought down to the center line of the bar**
- **greater support of the cutting edge is provided**
- **better chip control (uses standard Kendex chipbreaker plate)**
- **boring operations performed better at higher speeds made possible with Kendex bar**
- **permits use of thin insert—greater resistance to thermal shock**
- **throw-away insert permits use of harder grades—greater resistance to edge wear at higher speeds**
- **cutting inserts index accurately (saves time on size adjustment)—less downtime**

Kendex Boring Bars, with the right grade of "throw-away" Kennametal* insert, can be used for both rough and finish boring of pieces up to several inches in diameter. The bar with 15-degree lead angle and square insert together with the bar for turning to a square shoulder with a triangular insert will take care of practically all boring operations—thus eliminating the need for a variety of styles.

Why not call your Kennametal tool engineer to demonstrate these new Kendex bars? He will also help you select the right grade of Kennametal insert for each boring operation. Or write for additional information, KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademarks

**Tests made on Warner-Swasey, Jones & Lamson, Gisholt and other turret lathes



Kendex Boring Bars for Turret Lathes with Kennametal "throw-away" inserts . . . eliminate costly grinding . . . index accurately without resetting tool . . . reduce machine downtime . . . slash cost per cutting edge . . . resist thermal shock . . . permit boring to close tolerances . . . better chip control (chipbreaker not shown in illustration at top of page)

C-2002

INDUSTRY AND KENNAMETAL ...Partners in Progress

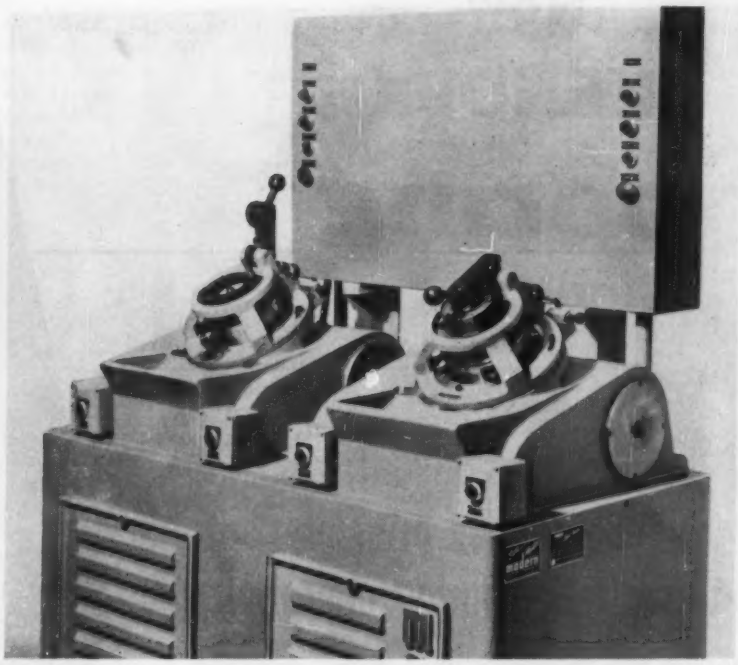
## Ramex Air Hammer Delivers 5400 Strokes Per Minute

Model AR-4 Ramex air hammer weighs only 4½ lb, can deliver 5400 strokes per minute. Air cushioning eliminates "kick." Tool operates on low air consumption, with a compressor delivering between 3.2 to 6.8 cfm.

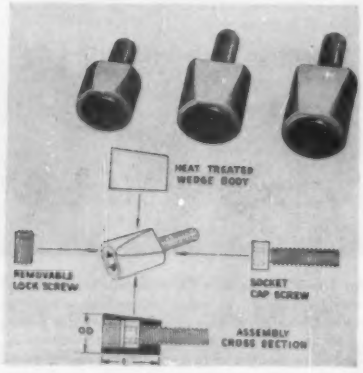
Hammer can be used with Pittsburgh lock seam guide, grooving tools for closing double seams, and taper-shank drill chucks. It can also be used with other air-hammer accessories such as chisels, caulking irons, and straight-fuller, bushing, and straight-seam tools.

Chrome-plated tool is provided with safety device which prevents action from starting unless tool is touching the work.

*E V Nielsen, Inc, 129 Broad St, Stamford, Conn*



PISTONS FOR AUTOMATIC TRANSMISSIONS are machined on 2-station Burr-Master machine which countersinks 20 blind holes. Parts are semi-automatically positioned and manually clamped; central and radial locations are taken from pre-drilled holes. Indexing is automatic, and production rate is 200 parts per hr. Machine drive is from ball-bearing-mounted V-belt. Two 1-hp, 1200-rpm, 220/440-v ac motors are used, one for each station—*Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich*




## Positive Lock Wedge Is Locked Or Released by Allen Wrench

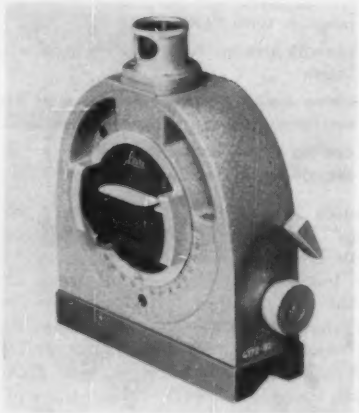
Vise-Lok, a positive locking wedge that can be tightened or released by an Allen wrench, turns in for wedging and positive locking, and turns out for easy tool indexing or removal. Wedge has three parts—wedge body with a 7° angle on the flat, the LH-threaded removable lock screw, and the socket capscrew that draws the wedge in or out of the tool assembly.

Device can be used in tool holders, milling cutters, lathe tools and other assemblies requiring a wedging principle. Standard sizes are ⅜ to ¾-in. OD and ⅜ to 1½ in. in length. Special sizes are available.

*Futurmill, Inc, 6360 Highland Rd, Pontiac, Mich*

**Electrical relays** are offered in two sizes, 0 and 00, and two types, FMP (fixed multiple pole) and IMP (interchangeable multiple pole). The Size 00 relay is rated at 10 amps, 600v ac, Size 0 at 15 amp, 600 v ac. Both types can be wired with conventional screw-clamp terminals or an optional plug-in receptacle. A latching attachment is also available. Complete line can be supplied with 2, 3, 4, 6, or 8 poles.

*Arrow-Hart & Hegeman Electric Co, Hartford, Conn*



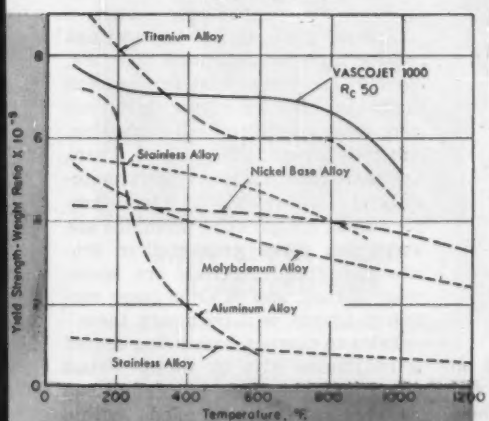
PRECISION CLINOMETER, made in Germany by Leitz, checks the inclination of machine elements to a level plane or to each other. Device can also be used to obtain surface flatness during machining operations. Body is aluminum casting, and base is permanently magnetized. Accuracy of optical circle and sensitivity of level are reported to be 15 sec of arc—*Imported by Opto-Metric Tools, Inc, 137 Varick St, New York, NY*

# VASCOJET 1000

## A new ultra high strength steel

presenting the highest strength-to-weight ratio at elevated temperatures *of any engineering material*

**Strength-Weight Ratios**



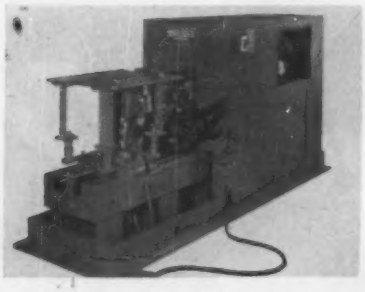

Now available for aircraft, ordnance and industrial applications, VASCOJET 1000 is a moderately-priced ultra high strength alloy steel possessing extraordinary properties. ● This steel is stable to 1000°F, surpassing in strength-to-weight ratio the best titanium and hardenable stainless alloys. It is of great importance for super-speed aircraft structures and skins, high-temperature fasteners and rotors. ● VASCOJET 1000 in normal temperature service at strength levels of 260,000 to 290,000 psi has the toughness, transverse ductility, fatigue strength* and freedom from residual stress that make it ideal for heavy-duty applications. Typical among these are aircraft landing gear, air frames, engine mounts, arresting gear and other critical components; fasteners, springs, pressure vessels; truck, train, airborne and portable equipment parts. ● VASCOJET 1000 is available in plate, sheet, strip, bars, extruded shapes, wire and forging billets. Write for comprehensive technical data.

*highest of any material reported

## Vanadium-Alloys Steel Company

**LATROBE, PENNSYLVANIA**

**SUBSIDIARIES:** Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)



FURNACE BONNET SECTIONS are horizontally seam welded on special air-operated single-phase Model MX-400 resistance welder. Parts rest and rotate on a horizontal adjustable table and are welded at the rate of 144 ipm. Main welding transformer is rated at 400 kva. Pressure system can apply a max electrode force of 3000 lb under an air-line pressure of 80 psi—*Sciaky Bros, Inc, Dept M-14, 4915 W 67th St, Chicago, Ill*

## Glass Dispersions Developed For Metalworking Lubrication

Two new glass dispersions provide a protective and lubricating coating for forging of special alloy steels, titanium, and other metals which are particularly subject to oxidation or gas absorption at elevated temperatures during pre-heating and forming.

Dispersions are applied at room temperature, forming a dry, continuous film which inhibits oxidation and surface contamination during the heating cycle. At a temperature below that at which the work is forged, the glass fuses to the surface, providing a true hydrodynamic film during the forming operation.

No. 239 contains a glass with fusion point of about 1100 F; No. 240 has fusion point of about 1300 F.

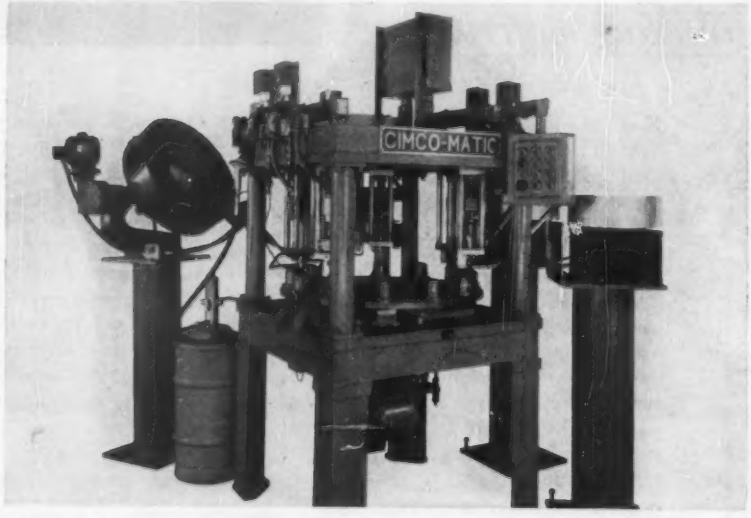
*Acheson Colloids Co, Port Huron, Mich*

## Sonic Analyzer Spots Mechanical And Electrical Flaws

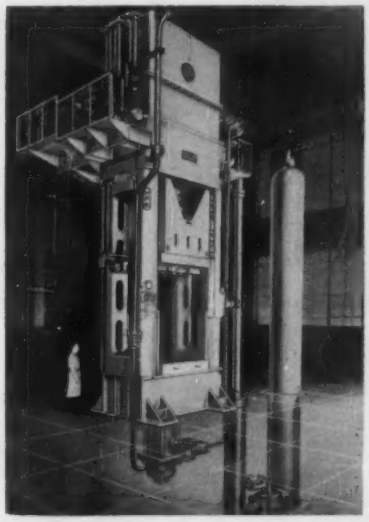
Model LP-1a sonic analyzer, through spectrum analysis of sounds, vibrations and waveforms, is used to identify mechanical and electrical defects and variations in many types of rotating and oscillating machinery. By converting any parameter to an electrical waveform through a sensing device such as a microphone, the unit makes it possible to determine relative strength of various components, to measure individual distortion components rather than total distortion alone, and to observe changes in energy distribution as the waveform varies or as design constants are altered.

An optional recorder may be added to give a permanent record of waveform content over extended periods. Analyzer has a logarithmic sweep range of 40 to 20,000 cps.

*Panoramic Radio Products, Inc, 10 S Second Ave, Mt Vernon, NY*




UPPER HORN BEARING ASSEMBLIES for 1957 automobiles are assembled on this 12-station machine which has a Model MDA24 LT index table, 36-in. dial plate, pneumatic-operated work stations, and electrical control system. Machine produces 900 complete assemblies per hr—*Cimco Engineering Co, Ann Arbor, Mich*



HIGH-EXPLOSIVE 8-IN. SHELLS are hot pierced on 1000-ton special hydraulic press. Press has bed area of 66 x 60 in., 98-in. daylight, 60-in. stroke, and is equipped with 150-ton hydraulic ejector with 24-in. stroke. Unit is equipped with pressure vessel (shown at right) of sufficient capacity to perform a high-speed pressure stroke of 19 in. Power system requires 530 hp for operation—*Hydraulic Press Mfg Co, Div of Koehring Co, Mt Gilead, Ohio*

## Norton Coating Protects Metals Against Heat and Erosion

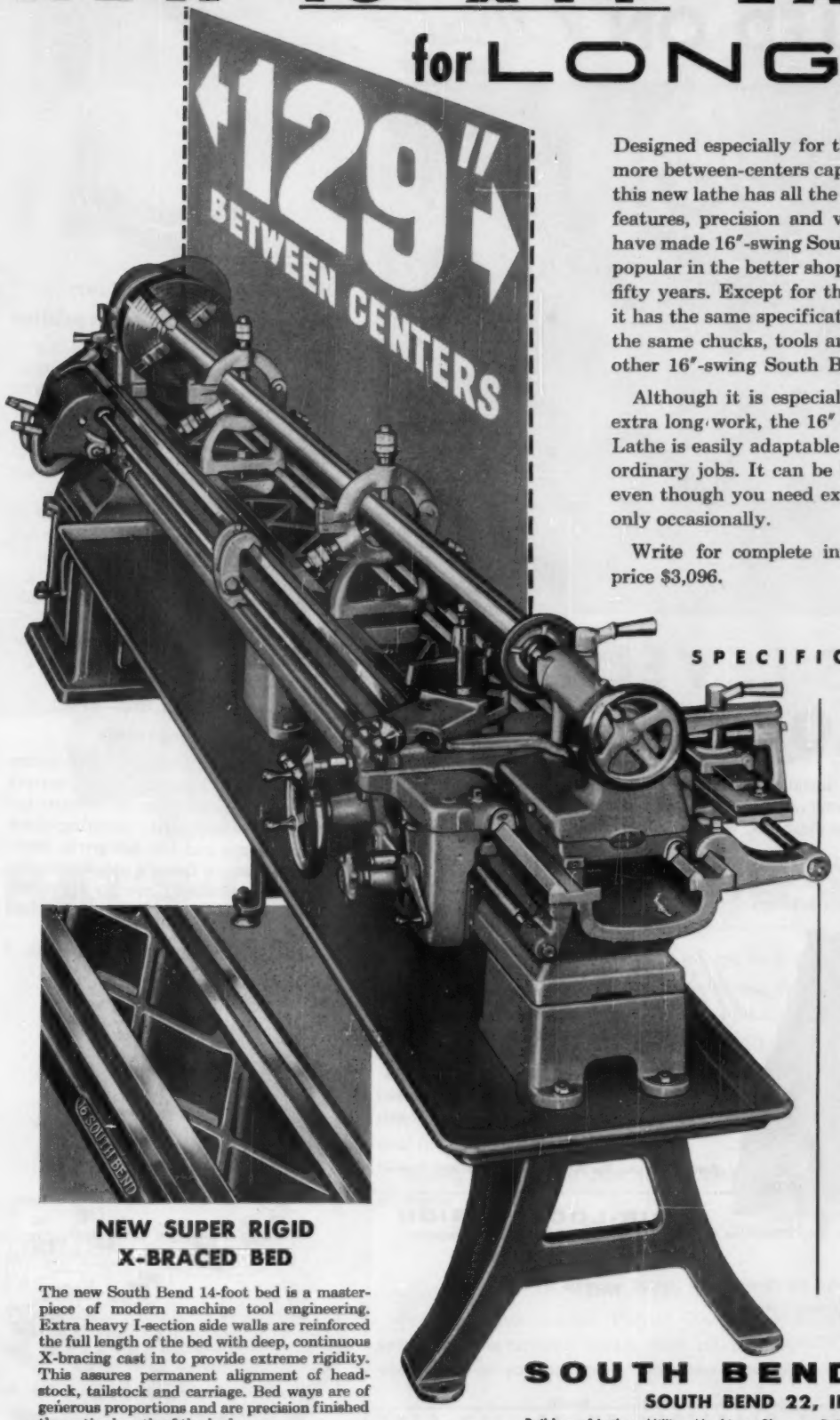
Rokide spray coatings consist of hard, adherent, crystalline refractory oxides which protect underlying material against high temperatures and abrasions. Available in three forms—aluminum oxide (designated Type A), zirconium oxide (ZS), and stabilized zirconia (Z)—coatings can be applied to a variety of materials, particularly metals.

General properties of the coatings include high melting point (3600 F), extreme hardness, relative chemical inertness, high resistance to corrosion, low coefficient of expansion, and resistance to mild impact. There are some limitations: ceramic materials are non-ductile at room temperatures; compressive strengths are about ten times greater than tensile strengths; materials are somewhat porous, and in some cases corrosive agents will permeate them.

Prior to coating, base being coated is roughened with an abrasive-blast operation. Thickness of coating can be accurately controlled within range of 0.005 to 0.100 in.

*Norton Co, Worcester 6, Mass*

# NEW 16″ x 14′ LATHE for LONG work




Designed especially for those who need more between-centers capacity (up to 129″) this new lathe has all the convenient features, precision and versatility that have made 16″-swing South Bend Lathes so popular in the better shops for more than fifty years. Except for the longer bed, it has the same specifications and takes the same chucks, tools and attachments as other 16″-swing South Bend Lathes.

Although it is especially suitable for extra long work, the 16″ x 14′ South Bend Lathe is easily adaptable to the more ordinary jobs. It can be busy all the time, even though you need extra capacity only occasionally.

Write for complete information — base price $3,096.

**SPECIFICATIONS:**

*Capacity* between centers.....129″

*Swing* over bed and saddle wings.....16¼″

*Swing* over saddle cross slide.....9⅝″

*Spindle* bore.....1⅜″

*Collet* capacity.....1″

*Spindle* speeds..(6 to 16) 15 to 980 r.p.m.

*Power feeds*, cross and longitudinal.....48 each

*Thread cutting* range .....48 pitches, 4 to 224 per inch.

## NEW SUPER RIGID X-BRACED BED

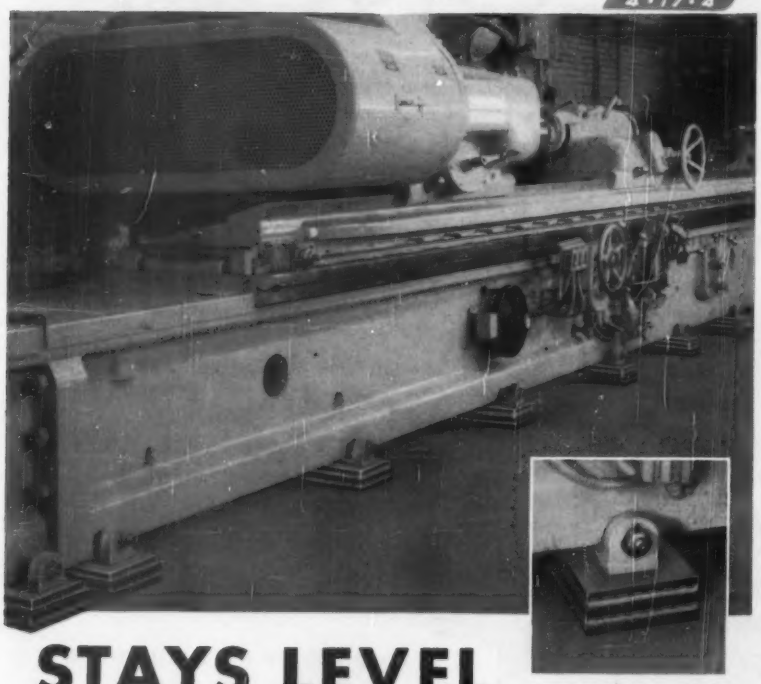
The new South Bend 14-foot bed is a masterpiece of modern machine tool engineering. Extra heavy I-section side walls are reinforced the full length of the bed with deep, continuous X-bracing cast in to provide extreme rigidity. This assures permanent alignment of headstock, tailstock and carriage. Bed ways are of generous proportions and are precision finished the entire length of the bed.

## SOUTH BEND LATHE

**SOUTH BEND 22, INDIANA**

*Builders of Lathes, Milling Machines, Shapers, Drill Presses and Pedestal Grinders*

# 45-TON GRINDER INSTALLED ON Air-Loc® 4·17·4



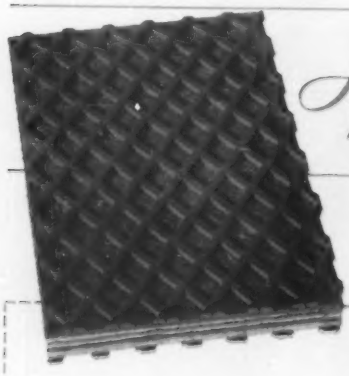
# STAYS LEVEL TO .0005"



Insert shows use of Air-Loc and leveling plates. No bolts or cement needed.

This Norton Grinder, installed on 26 AIR-LOC mounts, is regularly checked for level at 3-month intervals . . . and always holds the .0005" level required by manufacturer's specifications, with no adjustments necessary.

Jigborers, grinders, lathes . . . all of your fine tolerance precision machines . . . should be installed on AIR-LOC to safeguard the accuracy originally built into them by the manufacturers.



Air-Loc® 4·17·4

You get a permanent precision installation with patented AIR-LOC mounts that *Resist* oil, water and alkali, *Permit* easy leveling, *Eliminate* need for bolts or cement, *Hold* machines in place, *Reduce* transmitted vibration from the floor.

Return Coupon for Air-Loc Samples and Booklet.

**AIR-LOC DIVISION**
Clark-Cutler-McDermott Company
Franklin, Massachusetts

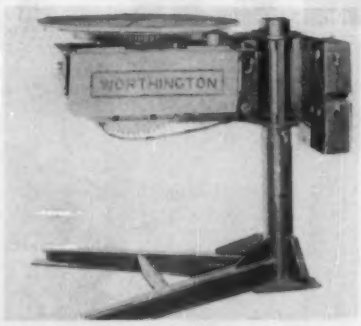
NAME..... TITLE.....
(Please Print)

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....




## Welding Positioner for Jobs Requiring Close Speed Regulation

Model 10P, designed for handling of lightweight weldments for manual and automatic operations, is driven by a 1/3-hp Servospeed electronic variable-speed drive which includes dynamic braking and jogging and has a speed regulation of 2% of set speed.

Unit has load capacity of 1000 lb at 4-in. eccentricity and 4-in. center of gravity. Round table has dia of 29 in. with four radial T-slots. Height adjustment is from 27 to 42 in., manually or motor operated.

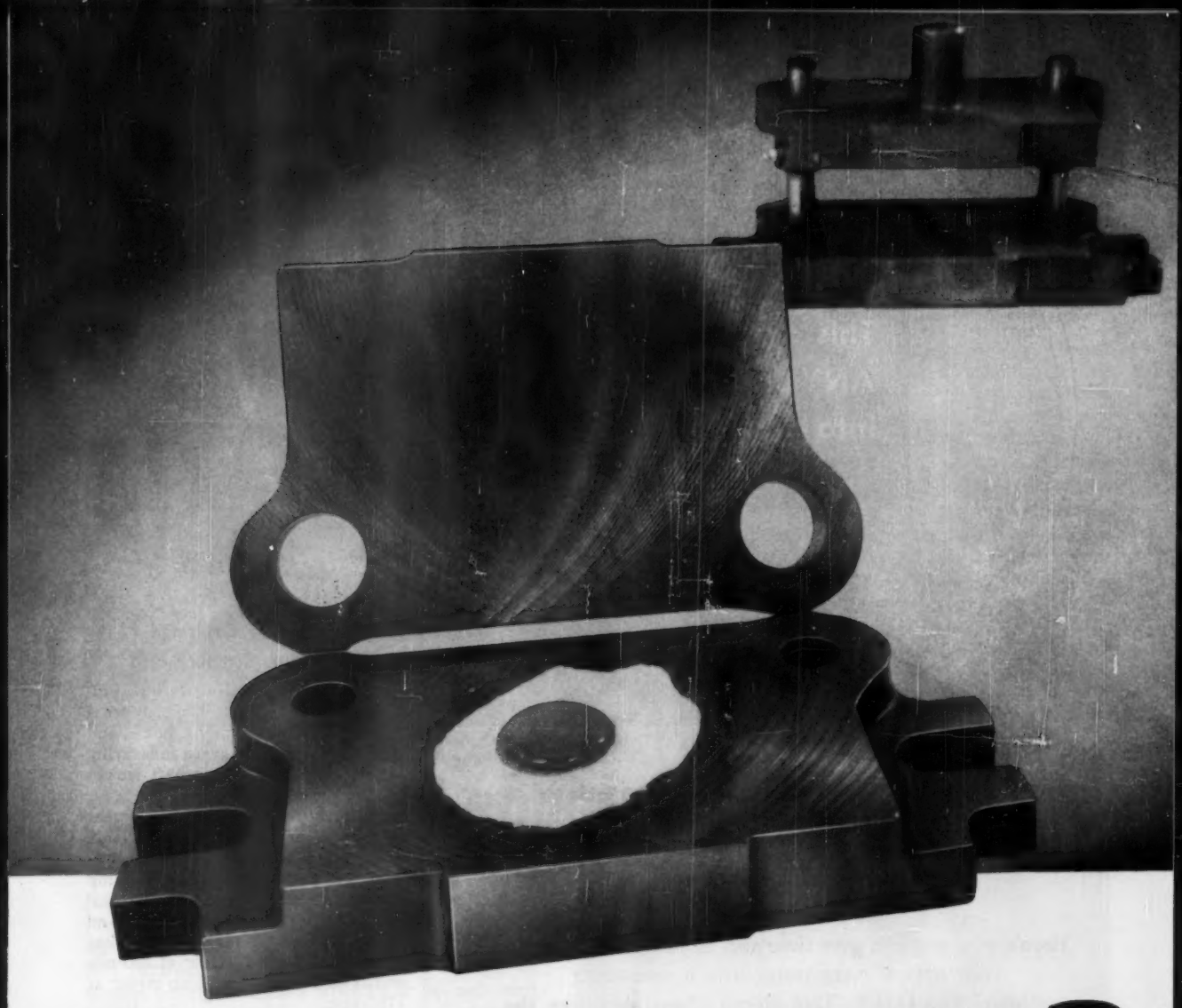
*Worthington Corp, Positioning Equipment Div, Harrison, NJ*

## Modular Cabinets Built From Basic Metal Components

Mass-produced modular enclosure system offers industry a wide variety of cabinets which can be constructed from 75 standard building-block components and 125 sub-parts. Modular units are factory sub-assembled and the purchaser merely bolts the units together to form a finished cabinet.

Forty different types of panels, 4

*"Why can't Brasher eat his lunch like the rest of us?"*



# WHAT'S COOKING ON DIE SETS?

The egg you've laid, brother, if the job isn't right.

Whether you're the tool engineer or the diemaker, once the die's in the line it has to produce or you've had it. And today it has to produce hundreds of thousands, even millions, of parts to pay for itself.

Obviously the die set is no place to cut corners. It's not only the heart of the die but frequently it's the least expensive part of the die anyway. A few dollars saved here won't go very far spread out over the life of the die, and it can prove costly.

Making quality die sets is our business. Quality means precision and stamina:

**Precision for fast, accurate diemaking and lasting production accuracy.**

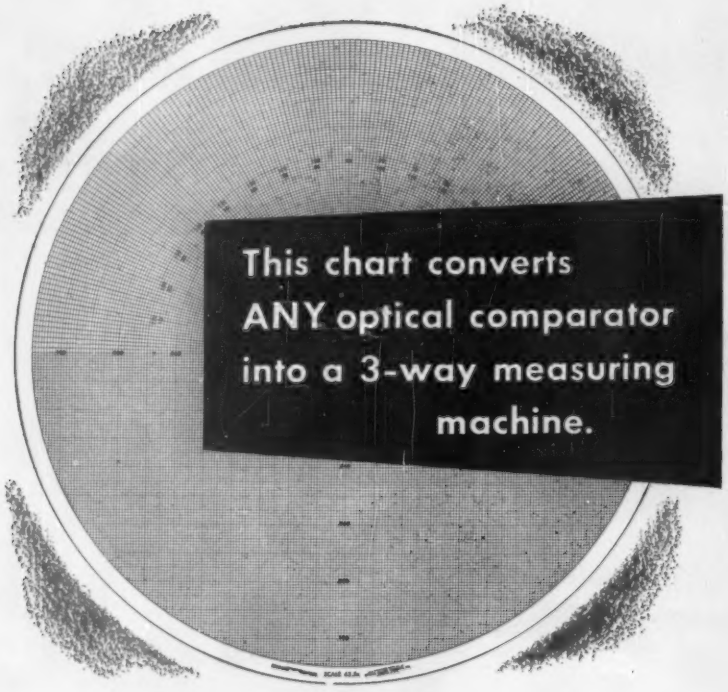
**Stamina to assure long, trouble-free operation in the line.**

For your convenience, Detroit Die Set stocks over 2000 standard die sets. Our new catalog covers them all, plus details on specials, too. Ask for your copy on your company letterhead today.

*OFFICES IN PRINCIPAL INDUSTRIAL CENTERS*

**Detroit DIE SET CORPORATION**

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.




O.G.P. TOOL ROOM CHART-GAGE with grids for vertical and horizontal measurements, protractor scale for angles, radius circles for measuring holes, fillets, etc.

Here's why you can save time and money by converting your optical comparator into a measuring machine: The O.G.P. Tool Room Chart simplifies the measurement of tools, dies, gages and parts. For your "run-of-the-mill" measuring jobs, you'll find this much faster than micrometers or gage blocks.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

USE THIS COUPON TO GET HELPFUL INFORMATION

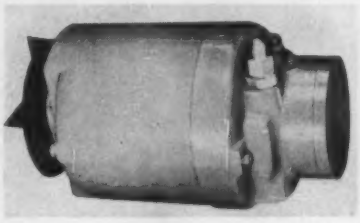
OPTICAL GAGING PRODUCTS, INC.
26 Forbes Street, Rochester, New York
I'd like more data on how to use measuring charts to save time and money.
Name.....Title.....
Firm.....
Street and Number.....
City.....State.....

OPTICAL GAGING PRODUCTS, INC.
SPECIALISTS IN PROJECTION GAGING




different size drawers ranging from 7 to 14 in. high and 16 in. deep can be fastened together with Philips screws and Tinnerman speed-nuts to form cabinets up to 81 in. in height. Components are made from cold-rolled steel and are finished in 2-tone-gray baked enamel.

*Elgin Metalformers Corp, 630 Congdon Ave, Elgin, Ill*

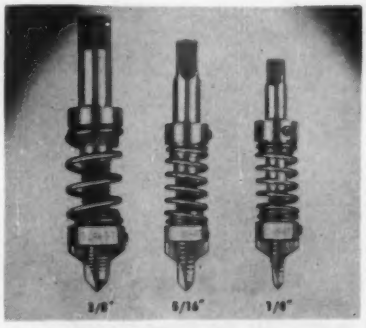


## Pump and Motor Combined In Lightweight, Compact Unit

Powermite model illustrated combines positive displacement internal gear rotary pump, driving motor, and cooling blower in a space measuring 8½ by 4¾ in. Single shaft serves all the units.

Designed for original equipment manufacturers, and furnished in large production runs only, unit is available in a wide variety of pump and motor combinations for hydraulic, oil burning, lubrication, and other services. Model pictured has capacity of 18 gal per hr at 300 psi, and is driven by a 1/12-hp motor at 1750 rpm.

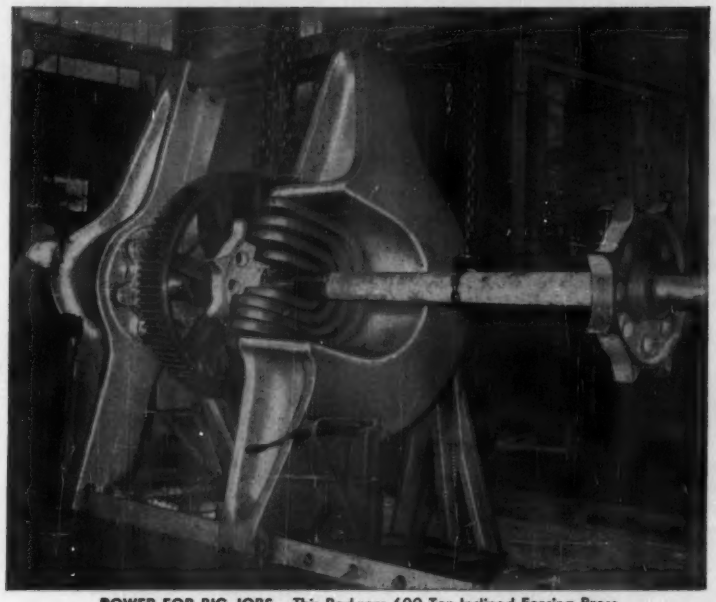
*Tuthill Pump Co, Dept PR, 939 E 95th St, Chicago 19, Ill*




## Chamfering Tool Deburrs Hole While Tapping

Burr-Bit slips over the tap, deburrs the hole as tap is being withdrawn. Adjusted to the varying web thicknesses of the tap by a Nylock setscrew inside the flute, device can be

# A MOUNTAIN of POWER



POWER FOR BIG JOBS—This Rodgers 600-Ton Inclined Forcing Press is forcing a large gear and sprocket from a mine machine shaft.

## —or a touch of pressure

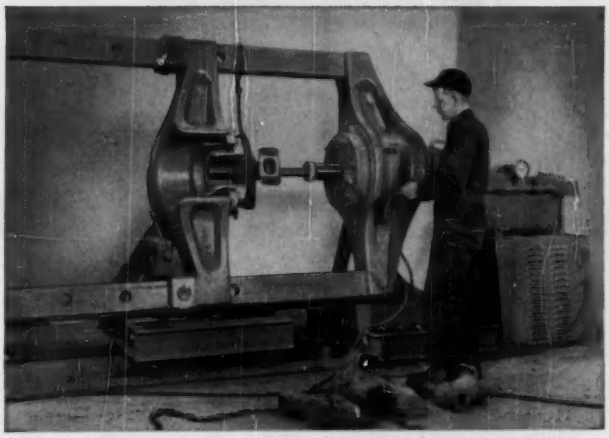
The heavy machines and equipment used in the great iron mining industry present a variety of problems when repair or maintenance is necessary. For this work the accurately controlled action of Rodgers Hydraulic Forcing Presses is a real time and work saver.

A Rodgers Forcing Press puts a mountain of power at your fingertips to force wheels, sprockets or gears from their shafts and for straightening, assembling, swedging or upsetting jobs. Operators also use the versatility, speed, power and positive control of a Rodgers Forcing Press to efficiently perform small pressing and forcing jobs with just a touch of pressure—tasks once done only on vertical shop presses!

## you get both with RODGERS FORCING PRESSES

Rodgers vertical, horizontal and inclined forcing presses offer capacities from 100 to 600 tons . . . up to 9 feet between tension bars . . . up to 16 feet between ram and abutment . . . single or double acting cylinders with 13 or 26-inch ram travel (72-inch travel available) . . . electrically powered hydraulic pumps with selective, positive pressure adjustment and remote control . . . removable press cylinders that can be used in special jacking or pulling jobs . . . and many more features that assure you of dependable, long life operation—all fully described in this Rodgers Catalog Number 315A.

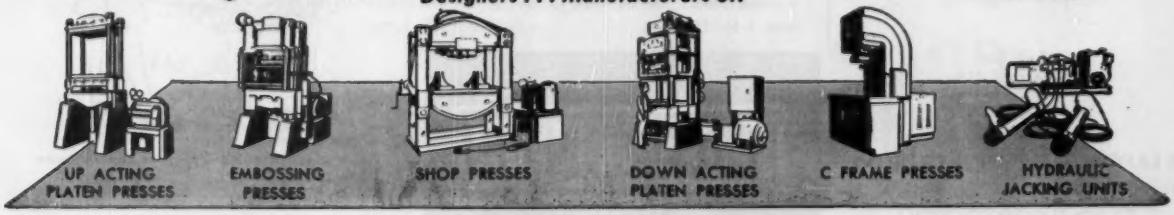
*Write for it today!*



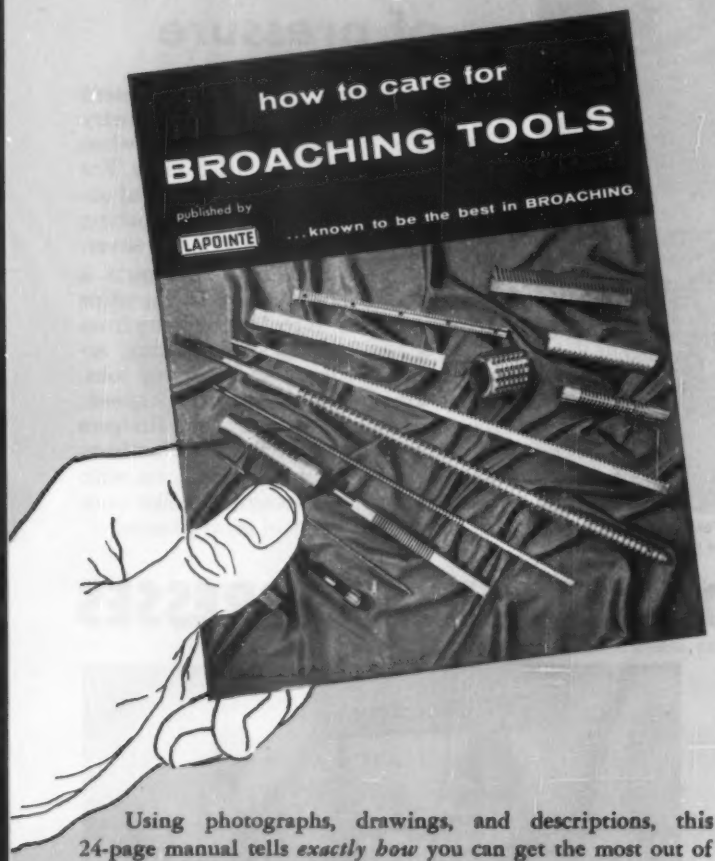
LIGHT TOUCH FOR SMALL JOBS—This Rodgers 300-Ton Inclined Forcing Press is used on small as well as large equipment repairs. Here, a pin is being pressed out of a tractor idler support bracket.

**Rodgers Hydraulic Inc.** 7407 Walker Street, Minneapolis 26, Minn.

*Designers . . . Manufacturers of:*



# This valuable manual published by LAPOINTE is yours for the asking




Using photographs, drawings, and descriptions, this 24-page manual tells *exactly how* you can get the most out of your broaching tools

- **while on the machine**
- **when re-sharpening**
- **in transferring between departments in the shop.**

Divided into three sections as noted above, there are nearly fifty specific recommendations in the booklet, plus a special section of seven tips of caution . . . "Never!" . . . using cartoons to drive home the points.

**A copy will be sent to you immediately on receipt of your request.**

**Ask for BOOKLET "2"**

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

**THE LAPOINTE MACHINE TOOL CO.**
HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

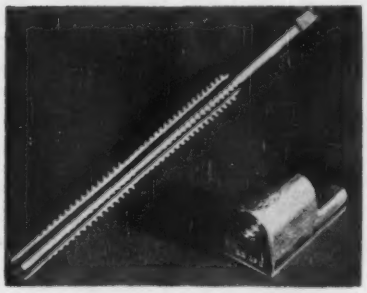
**LAPOINTE**
known to be the best in
**BROACHING**




used on practically all taps of all manufacturers.

Unit will reportedly operate efficiently where material is thin, since it chamfers just the top thread, allowing more threads per inch for gripping. Fits all two and four-fluted taps from No. 2 to ½ in. in all pitches.

*Vernon Devices, Inc, 481 E 3rd St, Mt Vernon, NY*



## Tap Produces Acme Threads In One Pass, Without Leadscrew

Roughing section of the tandem-style Unipass has a thread with greater included angle (to 50°). Threads can be relieved more effectively, and the wide flat Acme crest is absent. Free-cutting characteristics eliminate tool breakage caused by excessive torque and chip loading.

Because starting threads serve as a pilot, reaming is eliminated. Leadscrew equipment and skilled opera-

*(Continued on page 200)*

*"Do you suppose it's trying to tell us something?"*

Factory Mutual Laboratories, Norwood, Mass.

# Factory Mutual Laboratories test

# SHELL IRUS FLUID 902

*the low-cost, fire-resistant hydraulic fluid*

Factory Mutual Laboratories, the well-known industrial testing authority, recently evaluated Shell Irus* Fluid 902.

The tests performed included:

1. **Flash Point**
2. **Autoignition**
3. **Flame Propagation**

The Shell Industrial Engineer can give you more information about these tests.

*Trademark

**In plant after plant, users find that Shell Irus Fluid 902 is comparable in fire resistance to much higher-priced hydraulic fluids.**

**SHELL OIL COMPANY**

**50 WEST 50TH STREET, NEW YORK 20, NEW YORK**
**100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA**

SHELL

# new automatic

production-type

# honing machines

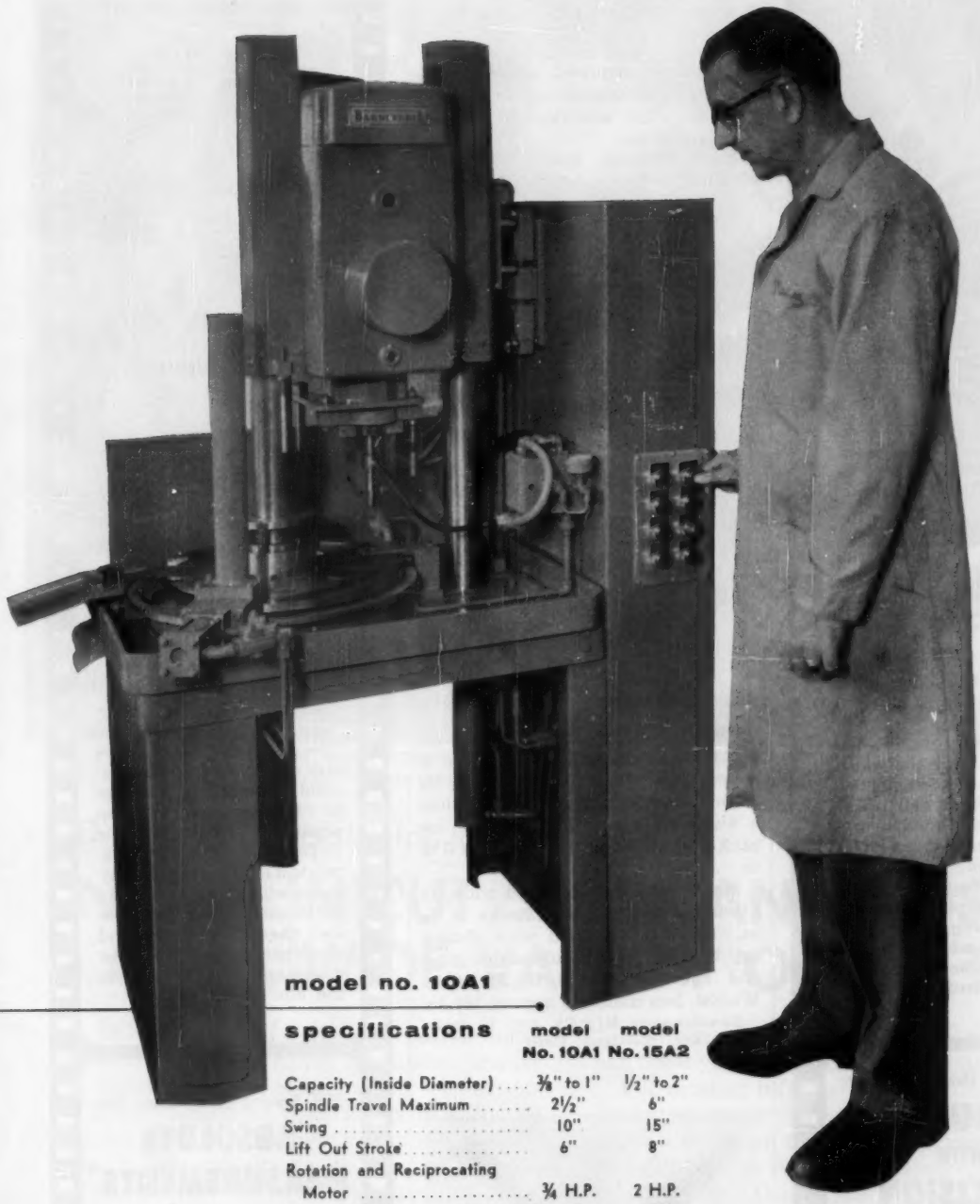
for bores up to 2″ diameter

Designated as Models No. 10A1 and 15A2, these new Single Spindle Vertical Honing Machines are an example of *complete* automation in small size, highly accurate, simple machines as designed by BarnesdriL engineers.

These machines feature air-impulse hone expansion with automatic rapid expansion, feed and collapse; automatic bore-to-bore sizing; and hopper loading. Automatic shut-down when stones are worn is also provided. Optionally, parts can be automatically pre-gauged, honed, post-gauged, sorted and ejected.

Because these machines have an all mechanical system with a Vee-belt spindle drive, size and cost are minimized and maintenance is greatly reduced. Rigidity and accuracy are further enhanced by suspending the reciprocating head between two columns.

If you have a bore finishing problem, send specifications and requirements for estimates of machines and tools to do the job.



**model no. 10A1**

| specifications | model No. 10A1 | model No. 15A2 |
|---|---|---|
| Capacity (Inside Diameter) | 3/8" to 1" | 1/2" to 2" |
| Spindle Travel Maximum | 2 1/2" | 6" |
| Swing | 10" | 15" |
| Lift Out Stroke | 6" | 8" |
| Rotation and Reciprocating Motor | 3/4 H.P. | 2 H.P. |
| Overall Height | 72" | 88" |
| Floor Space | 32" x 45" | 42" x 63" |
| Net Weight | 1150 lbs. | 1650 lbs. |
| Gross Weight (Crated for Domestic Shipment) | 1450 lbs. | 1950 lbs. |
| Gross Weight (Boxed for Export Shipment) | 1750 lbs. | 2250 lbs. |
| Cubical Area for Export Shipment | 159,600 cu. in. | 162,480 cu. in. |

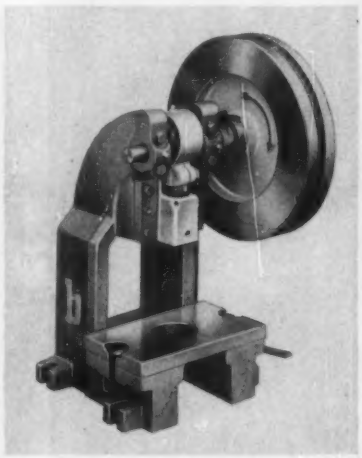
50th year

**BARNES DRILL CO.**

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

tion are not required, while thread tolerances are maintained on starting threads. Taps are available in all standard sizes.

*Regal Division, Beloit Tool Corp, Beloit, Wis*

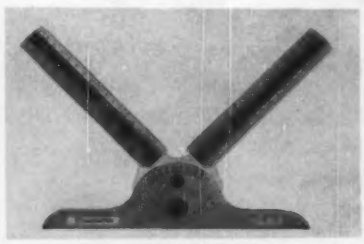


## Benchmaster Press Has Wide Gap Between Column Members

Designed for operations requiring a wide gap between column members, 2-ton fixed-bed, gap-frame press has a 4½-in.-wide opening through the back and a bed measuring 4½ x 7½ in.

Max shut height, bed to slide, is 4½ in. with a standard stroke of ¾ in. Press is equipped with sliding key-type clutch, has adjustable gibs, and operates at 280 to 290 spm. Weight, less motor, is approx 100 lb.

*Benchmaster Mfg Co, 1835 W Rosecrans Ave, Gardena, Calif*



## Drafting Machine Available With Wide Choice of Scales

Made of acrylic plastic, the Adjustable Scale-Drafter has two beveled flat scales attached to a swivel quadrant. Quadrant rotates on a base that is graduated from 0 to 90°. Clamping screws lock quadrant in any desired position. Device can be

SIP

GUARANTEED ACCURACY

—as attained with any of the 7 SIP JIG BORERS and SIP OPTICAL JIG BORING, MILLING and MEASURING MACHINES—will furnish your plant with the permanent means (1) to define, establish and maintain the highest possible precision standards in your manufacturing processes, so as (2) to improve your quality-of-output and economy-of-operation. These and other profit-advantages are interestingly demonstrated in the film offered below.

FREE Showing 16mm. Sound Film

"PRODUCTION WITH PRECISION"

AMERICAN SIP CORPORATION
100 East 42 Street, New York 17, N. Y.

Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Production with Precision."

NAME

FIRM

ADDRESS

CITY

STATE

SIP

GUARANTEED ACCURACY

has developed from more than 90 years' specialization with practical metrology. The resulting SIP techniques—as used in length measurements by national Bureaus of Standards—may be most profitably applied with SIP UNIVERSAL & LINEAR MEASURING MACHINES, SIP high precision MICRO-INDICATORS, and SIP PROFILE PROJECTORS. How well these techniques and machines can work to your advantage is illustrated in the film offered below.

FREE Showing 16mm. Sound Film

"ABSOLUTE MEASUREMENTS"

AMERICAN SIP CORPORATION
100 East 42 Street, New York 17, N. Y.

Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Absolute Measurements."

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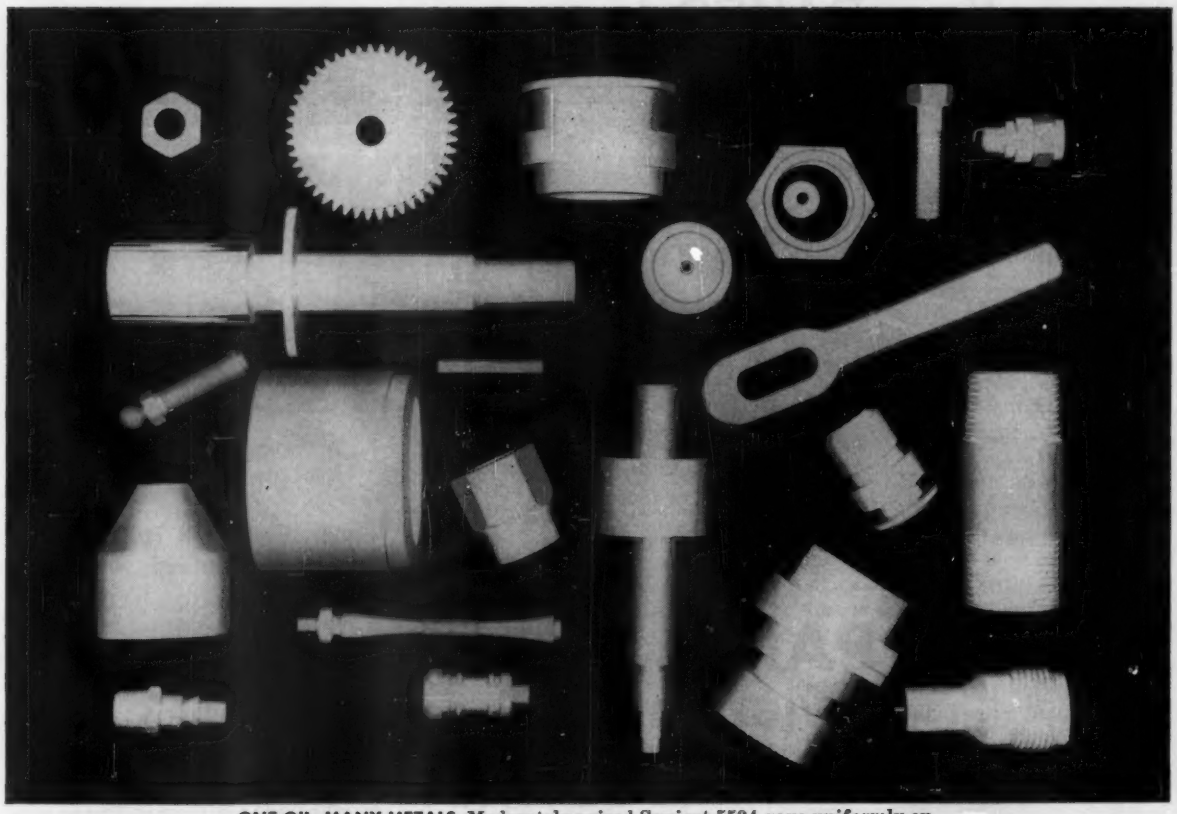
STATE



**ONE OIL, MANY METALS.** Moderately priced Sunicut 5534 gave uniformly excellent results in the machining of this wide variety of top-quality steel parts.

*Designed especially for job shops...*

# NEW SUNICUT 5534 CAN BE USED ON A WIDE VARIETY OF STEELS

SUNICUT® 5534 ends your search for a single cutting oil that can assure quality machining of a wide variety of ferrous metals...ranging from B1112 to 4130 and including free-machining stainless steels.

A non-emulsifying, transparent cutting oil, Sunicut 5534 can speed production of general screw machine and turret lathe work. It gives excellent finish in tapping, drilling, threading, and light stamping operations and can be used on many special jobs run at both high and low speeds.

Try moderately-priced Sunicut 5534. It can save you money by reducing your cutting oil inventories and oil change time. It can boost your production and profits.

For detailed information, prices and delivery data about this new, versatile cutting oil, call your Sun representative today. Or write directly to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-5.

SUNOCO®

**INDUSTRIAL PRODUCTS DEPARTMENT**

## SUN OIL COMPANY Philadelphia 3, Pa.

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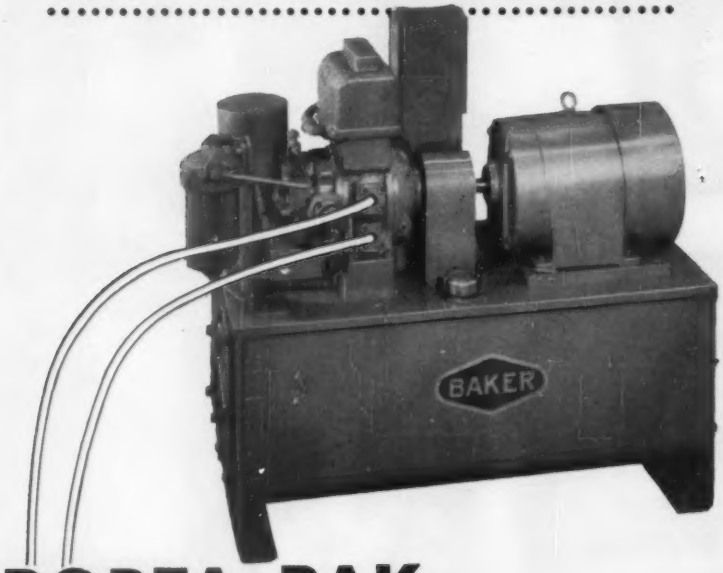
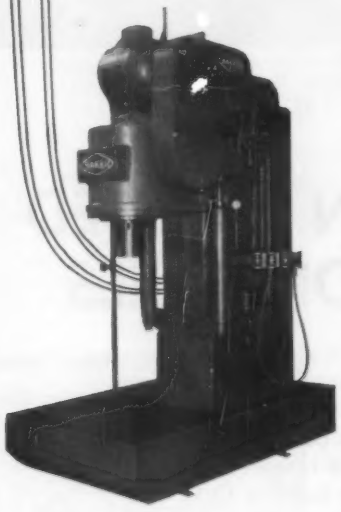
IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

# another BAKER bonus




## PORTA-PAK

## . . . SERVICE IS A SNAP



Here's a *separate* hydraulic power source that's attached to the machine only through the hydraulic lines. So it can be placed in any convenient location . . . and it's always easily accessible for service. A completely self-contained unit. Porta-Pak can be furnished on all Baker specials — or on Baker Basics, for automation with *standard* machines.

BAKER

**AUTOMATION**

*Best in the long run*
*Practical in the short run*

**CHECK AND MAIL FOR DATA**

( ) Porta-Pak hydraulic power source
( ) Exclusive twin-pull hydraulic feed cylinders — compact, easily accessible.
( ) Hardened, ground steel or cast iron ways — durable
( ) Big ball bearings throughout, rugged construction

**BAKER BROTHERS, INC.**
**Dept. AM-557, Toledo 10, Ohio**

Yes, tell me more about these Baker Bonuses.

NAME AND TITLE
COMPANY
ADDRESS
CITY ZONE STATE




ordered with 6- or 12-in. scales in either architect's, engineer's or mechanical draftsman's models.
*Alvin & Co, Windsor, Conn*

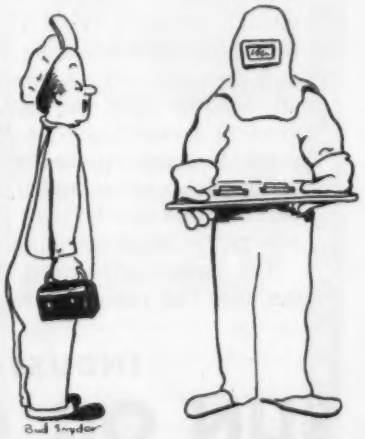
### Hyster Outside Lift Truck Handles 7000-lb Loads

Pneumatic-tire lift truck, Model 70, is designed to work over rough terrain. Truck, which can handle 7000 lb, has a turning radius of 100 in. and a length of 106⅜ in.

Large bore and stroke enables the 70-hp engine to develop a rated torque of 182 ft-lb at 1200 rpm. Hydraulic-booster-type power steering is standard equipment. Truck can be equipped with a number of special attachments in addition to lifts.
*Hyster Co, 2902 NE Clackamas St, Portland 8, Ore*

### Overhead Cable Conveyor System Available as Complete Package

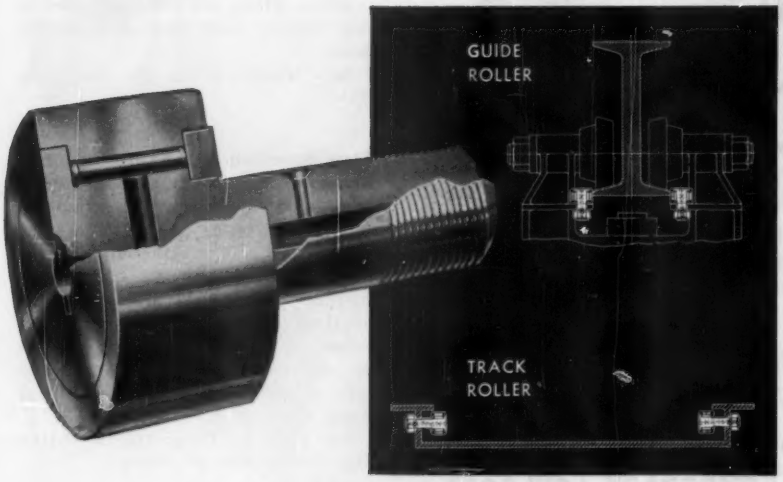
Standardized floor-mounted supports, designed to simplify installation of overhead cable conveyors, may be lag-bolted to the floor, or



*"Remember now! Come out as soon as the cheese starts to melt!"*

# BEARING TIPS by McGill

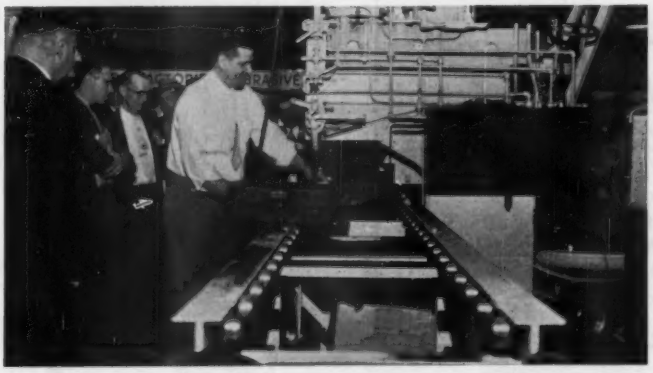
## Let a CAMROL bearing be your guide



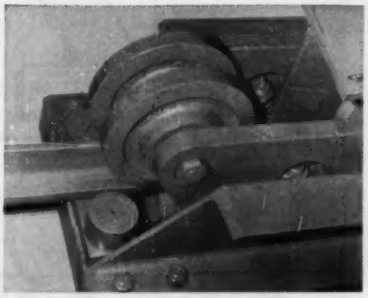

### Obtain freer rolling, improved alignment and positive side thrust

In guide and support roller applications CAMROL Cam Followers insure free rolling action and positive side thrust while eliminating the wear of more costly flanged wheels. Then, too, they provide improved alignment and low starting and running friction with high unit load and shock capacity, especially at low speeds as track rollers. Lubrication is simplified and maintenance can be reduced to a minimum in these applications. Specify the interchangeable sealed SGR series for added protection against contamination.

### CAMROL CF bearings provide friction-free track rollers for automatic mold blower



McGill CAMROL CF rollers are used as guide rollers to form a mold conveyor in the Beardsley & Piper MBS-20 Mold Blower. The machine blows and squeezes cope or drag in a single automatic operation, handling up to 4 molds per minute. The CAMROL CF bearings replaced less efficient friction rollers in this application. Although, the duty here is rather light and speeds slow, the cam follower bearing provides lesser starting and running friction. This helps speed the flow of work from the machine, which must be fast and automatic. The integral stud feature eases assembly and its standard design simplifies procurement.



### CF bearings minimize maintenance as crane side guide rollers

McGill CF cam follower bearings serve as side guide rollers in overhead cranes manufactured by Louden Machinery Company of Fairfield, Iowa. Freedom from maintenance, a time saver because of the inaccessibility of the bearing when the crane is in operation, is an important advantage of the cam follower bearing.

**Send for Catalog No. 52-A**

*Insure performance with* McGILL®

MULTIROL® GUIDEROL® CAMROL
Precision Needle Bearings

**McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA**

placed on the floor and then sway-braced to plant walls.

Pre-engineered hollow pipe stanchions are used with standard Tipp brackets and adapters to make up the supports; all parts are interchangeable with existing Tipp equipment. Bolts are used to assemble the systems, which are pre-assembled in the factory and shipped knocked down.

*Tipp Manufacturing Co, Tipp City, Ohio*

**Flaw detection fluid** called Immunol 438, for use in aqueous phase magnetic particle inspection of metals, replaces kerosene and mineral spirits, and is said to give better definition of flaw and to prevent rusting. Material is nonflammable, odorless, and self-cleaning. Fluorescent or non-fluorescent paste can be uniformly suspended in a mixture of one part Immunol 438 to 17 parts water.

*Harry Miller Corp, 4th & Bristol Sts, Philadelphia 40, Penna*

## Instrument Tests Hardness of Non-Metallic Coatings on Metal

Device can test virtually all forms of coated metal, including flat stock, and is said to eliminate human errors and to supply laboratory-like precision within plant production standards. Developed and licensed by Crown Cork & Seal, Inc, Baltimore, the instrument is easy to use. A stylus, linked to a thyratron through an electronic circuit, rests

*(Continued on page 208)*


# Want better Service on STAMPINGS? ...then count

Our ability to use the best of *three* stamping techniques, each our own exclusive development, assures lowest possible cost on any quantity—one to a million or more.

**1** A FEW PIECES—at Experimental or Pilot Stage

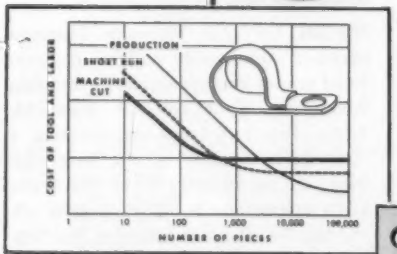
**NO DIES!** Our machine cut method, applying custom-built slitters, cutters, saws, files and stock punches—PLUS special techniques and skills—produce these small quantities at very low cost.

**2** SHORT RUNS

**TEMPORARY LOW-COST TOOLING!** To produce something more than a few, but less than high production quantities, our simple contour dies—PLUS special purpose presses – keep costs low.

**3** PRODUCTION RUNS

**MODEST DIE CHARGES** on larger quantities! Here is where our regular production tooling applies to advantage...to deliver high quantity Stampings, and at lowest possible unit cost.




**You can rely on it...WE LOOK AT ALL THREE – then determine the best method for fast, efficient, low-cost service. Let us quote on your next Stampings job.**

*Free 12-page booklet shows how to save on stampings... write for it.*

**STAMPINGS DIVISION**

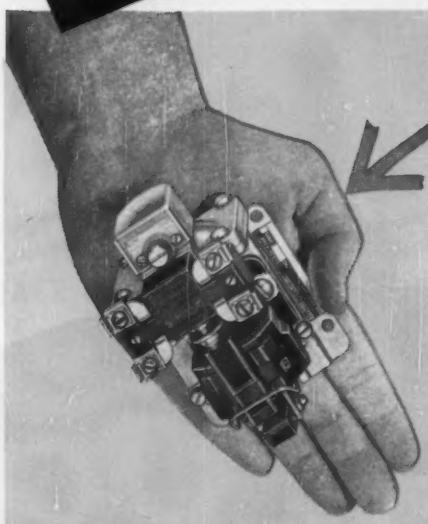
*"One Piece or a Million"*

3105 Union Street, Glenbrook, Conn.

LAMINATED SHIM COMPANY, INC.

*"Why can't you come in here, Jackson, for your pay like the rest of the men?"*

# What's Your Timing Problem? —ONE OF THESE TIMERS WILL DO YOUR JOB *Exactly!*



## *NEW*...Type A

**REALLY SMALL IN SIZE AND COST!**

for applications requiring shorter timing periods, ±15% accuracy and no interlocks

## Type B

**MACHINE TOOL STANDARD FOR MORE THAN 20 YEARS!**

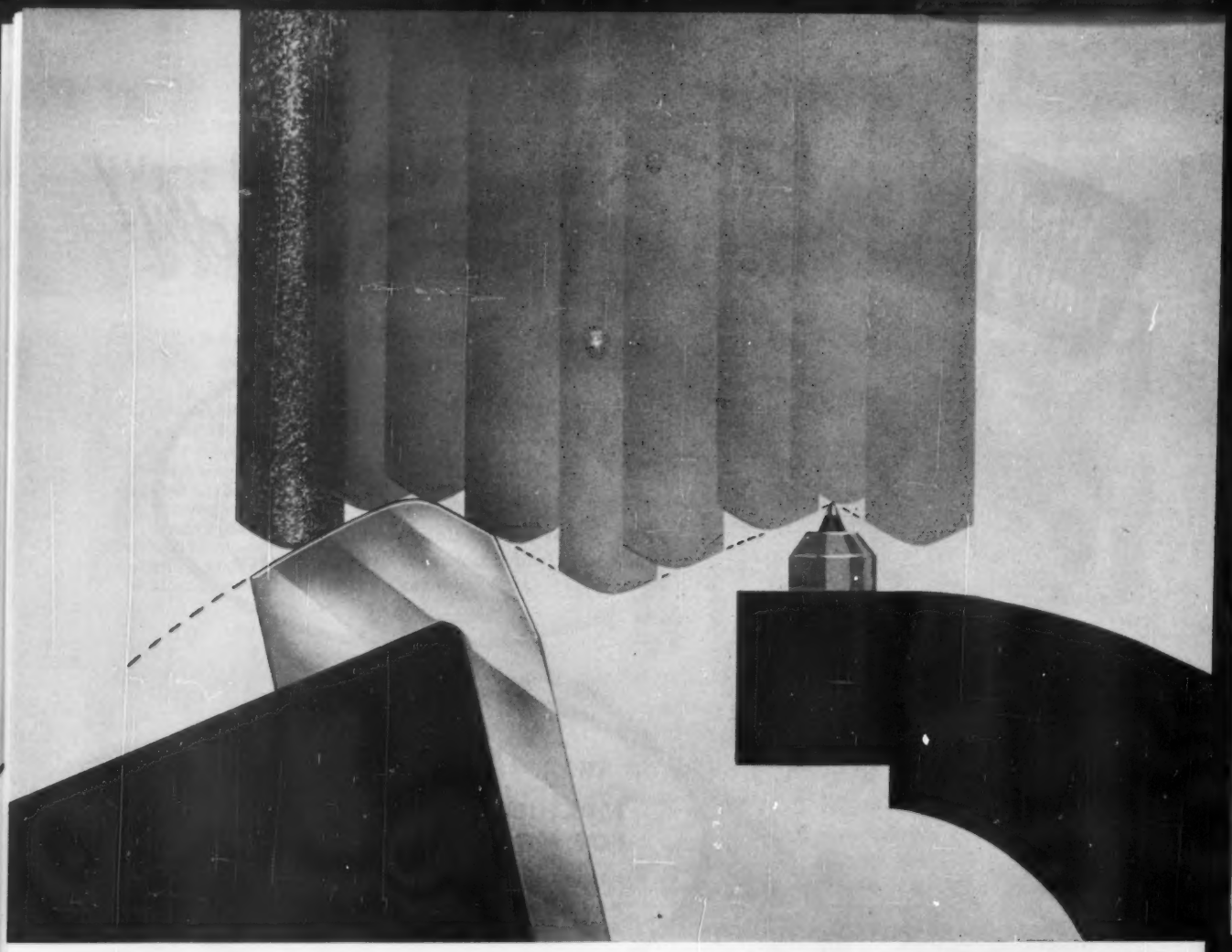
for applications requiring timing periods up to 3 minutes, maximum accuracy and 1 or 2 instantaneous interlocks

| COMPARISON | TYPE A | TYPE B |
|---|---|---|
| Timing Period | .2 to 1 min. | .2 to 3 min. |
| Accuracy | ±15% | ±10% |
| Interlocks | None | Max. 2 Double Circuit |
| Panel Space | 2⅝" x 4" | 2½" x 7⅛" |
| Convertible Delay-On • Delay-Off | Yes | Yes |
| Maximum Voltage AC—DC | 600 V. AC only | 600 V. AC 250 V. DC |

*Write for Timer Bulletin 9050*
*Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin*

**NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE**

**SQUARE D COMPANY**



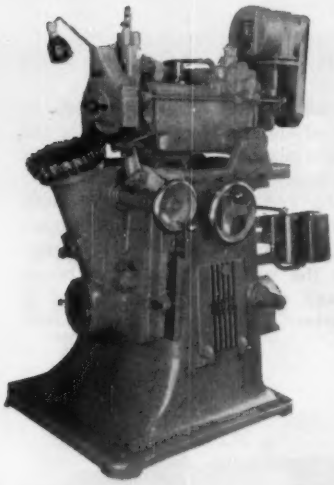
## Oliver AUTOMATIC Face Mill Grinder

# Wheel dressed with every stroke

*Oliver face mill grinders are made in four sizes to accommodate cutters from 4" to 21" diameter.*

The drawing above shows the grinding wheel passing over a cutter tooth after being dressed and formed automatically by a fixed diamond. This happens with each stroke of the Oliver automatic face mill grinder. Thus, complete accuracy of grind is certain regardless of the number of teeth in the cutter. This exclusive Oliver of Adrian feature prevents loading of the wheel and also permits carbide grinding with a silicon carbide wheel. Automatic feed-down accurately compensates for each dressing thus providing a fixed grinding line.

The machine automatically indexes the cutter and controls the tooth shape by a simple cam arrangement so that any practical roughing or finishing form can be obtained. The machine grinds the corner angle, corner radius, face and dish all in one operation. Oliver's face mill grinder is hydraulically operated for smooth, fast (4 to 8 times faster per cutter), accurate and quiet performance.



**OLIVER** *Automatic*
## FACE MILL GRINDER

. . . features real economy and fast, accurate grinding. One operator handles several machines. Set-up is simple. The cutter is mounted on the face plate and the automatic indexing mechanism adjusted. Required clearance is set by moving the work spindle to the desired position. All surfaces and radii are ground in one continuous operation.

**OLIVER** *General Purpose*
## FACE MILL GRINDER

. . . heavy duty; for all types of face mill grinding on coarse and fine pitch cutters from 4″ to 24″ in diameter. All angles and clearances are instantly obtained without calculation. The cutter face, periphery and corner angles may be ground without altering the lip rest setting. The machine is completely universal.

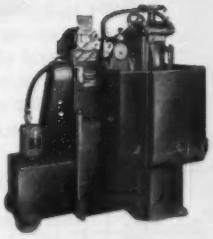
**OLIVER** *Arc Radius*
## GRINDER

. . . for accurate sharpening of face mills, channel cutters, slotting cutters, etc. The face, periphery and corner radius are ground with one pass of the wheel; radius blended in perfectly. The machine will sharpen any radius up to two inches. Periphery clearance may be greater than the face. If desired, the machine will give a straight grind. High speed, diamond wheels may be used.

## *More* **OLIVER** *of* **ADRIAN** *Tool Grinding Equipment*

**ACE TOOL and CUTTER GRINDER**

Universal—grinds milling cutters, other cutting tools. Especially suited to grinding tungsten carbide.



**TEMPLATE TOOL BIT GRINDER**

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.

**No. 510 DRILL POINTER**

Semi-automatic. For drills ¼″ to 3″ in diameter. No. 21 bench models available for size ½″ and smaller.

**DRILL POINT THINNER**

For low cost reclaiming of drills. Corrects off-center and too-thick webs and out-of-index cutting edges.

**DIE MAKING MACHINE**

Produces dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. 5 designs in 2 types.

*Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .*

**OLIVER** of **ADRIAN**
**OLIVER INSTRUMENT COMPANY**
1414 E. Maumee St. • Adrian, Michigan

- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder

NAME_____

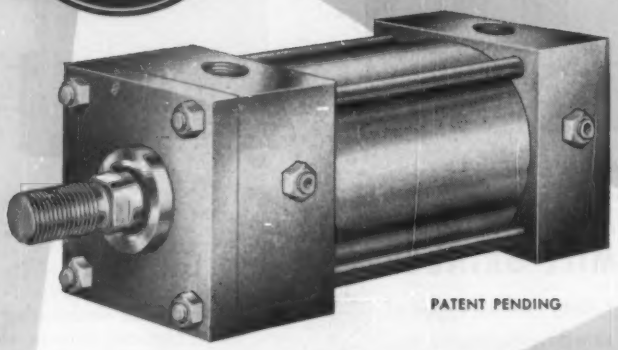
COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

# FOR AUTOMATION

# S-P CYLINDERS



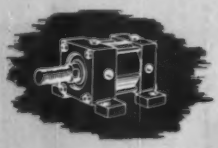
PATENT PENDING

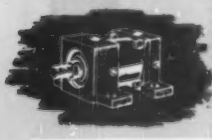
## top performance–longest life

All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.

**S-P STANDARD AIR CYLINDERS** have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

**S-P HEAVY DUTY AIR CYLINDERS** for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.





**S-P HIGH PRESSURE HYDRAULIC CYLINDERS** have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

SPecify SP

THE S-P MANUFACTURING CORP.

SOLON, OHIO • *IN GREATER CLEVELAND*

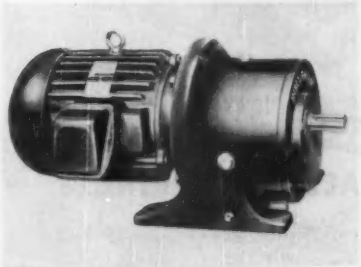
ESTABLISHED 1916 — A BASSETT COMPANY

NON-ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS
POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES




on surface of sample. Weight, in form of spool-shaped weight, is applied to stylus gradually. If weight is sufficient to cause stylus to pierce coating and come into contact with metal surface, the thyratron closes a relay and a calibrated scale indicates the weight required to break through coating.

*Gardner Laboratory, Inc, Bethesda, Md*



GEAR MOTOR called Ritespeed is available from stock in all speeds from ½ to 15 hp. A feature of the motor is the simplicity with which the cartridge assembly and electric motor can be removed from the gearcase without touching the base of the unit. All integral sizes have totally enclosed, fan-cooled motors, NEMA standard D flange, at no extra cost—*Rockwood Pulley Mfg Co, Inc, 20 Crosby St, New York 13, NY*

**Small-hole attachment** for turret drilling will drill deep holes from 0.004 to 0.1969 in. in diameter. Precision collets are used instead of bushings to hold the drill, reducing setup time and eliminating costly tooling time. Adaptable to all standard

*"If a good machinist doesn't need any tools . . . why do you keep borrowing mine . . .?"*

*This Month's*

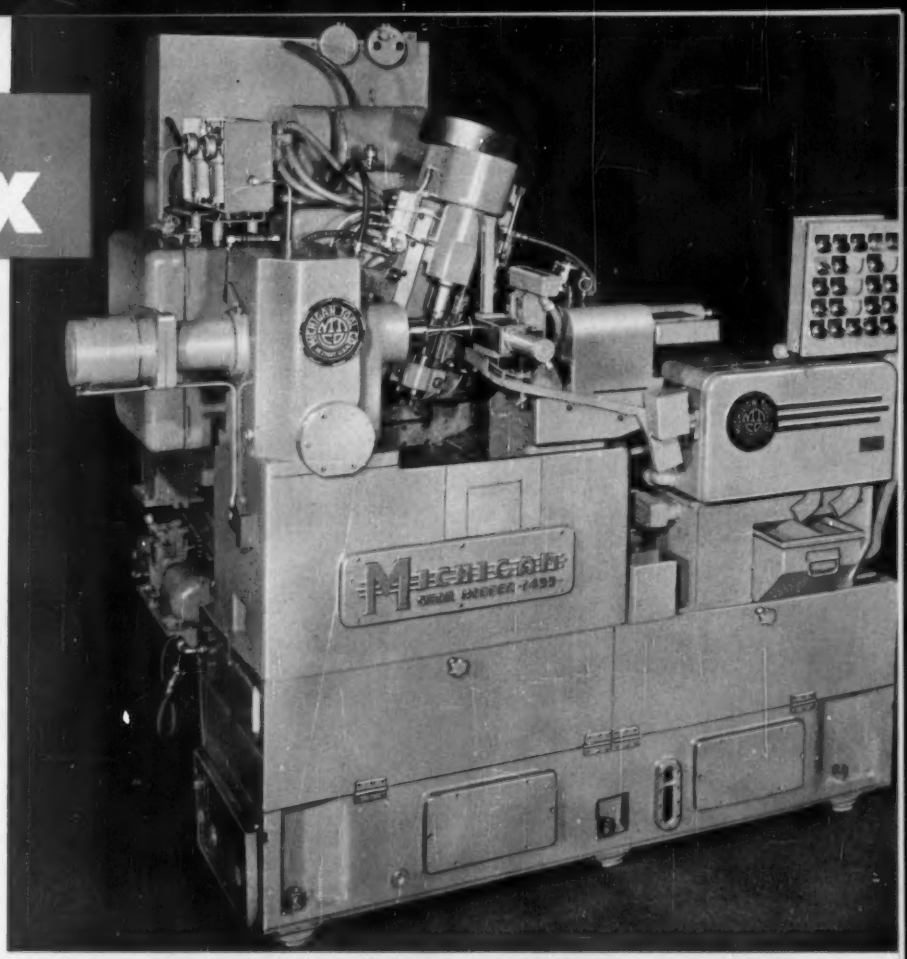
# GEAR PIX

*Announcing*

## A NEW HIGH-SPEED TANDEM GEAR HOBBER

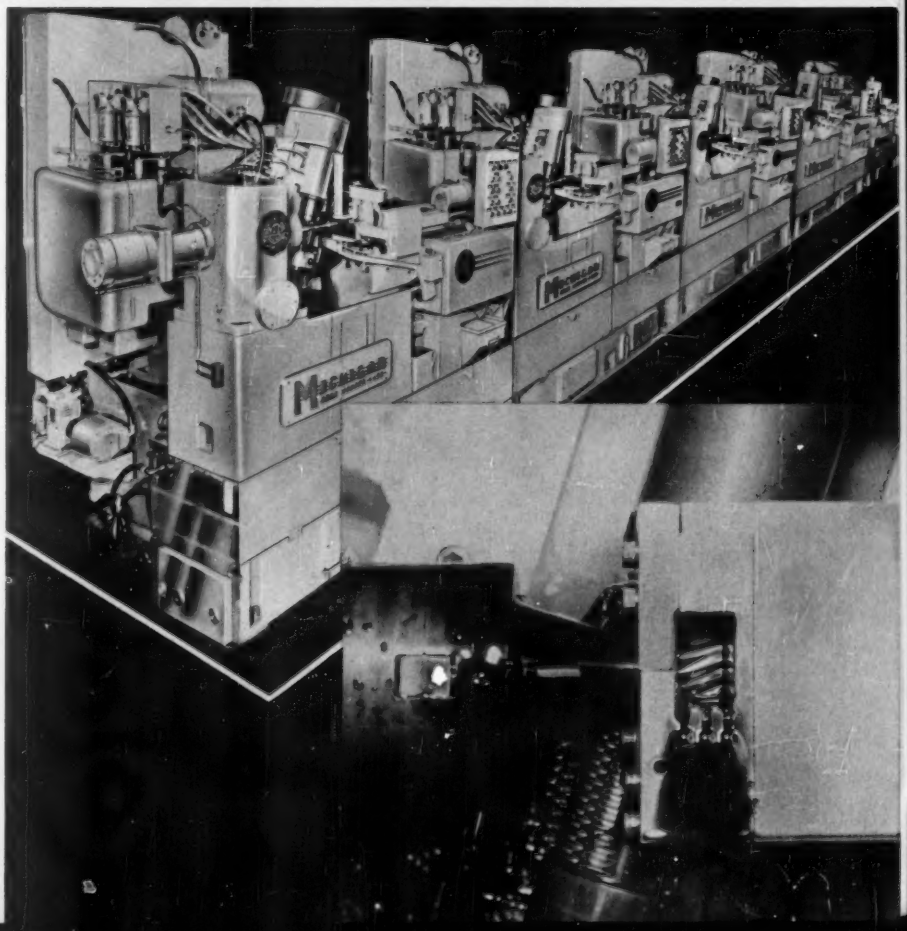
### *a new concept . . .*

. . . supplies the answers to gear production problems. It's Michigan Tool's newest, the Tandem High-Speed gear hobber, Model 1433. A machine that can be set up in tandem or in-line series to tailor gear output to needs. The 1433 will precision hob spur gears up to 12 pitch or helical gears up to 30° helix. Center distance between hob arbor and work spindle is 3½ inches. Maximum crossfeed stroke is 4 inches.




### *. . . a new dimension*

This new hobber lends itself to any degree of automation. Blanks may be supplied from an overhead distribution system. A common sub-base—in any length or configuration—provides parts removal from any number of machines. All machine services including the master panel and electrical connections are self-contained as part of the basic "building-block." Sub-bases are readily joined side by side to any length for any production rate.



### *. . . a proven principle*

The 1433 single-spindle hobber features "plunge" or standard cutter feed, vernier-scale helix angle setting and an automatic expansion arbor for workholding. Set up is fast and simple. Hob speeds range up to 500 rpm—hob feed is infinitely variable. Automatic size control is also provided. Cut gears, automatically unloaded, are air-blast cleaned and automatically checked.

For complete information on Michigan's Tandem gear hobber, write for Bulletin TH-33.

**MICHIGAN TOOL COMPANY**

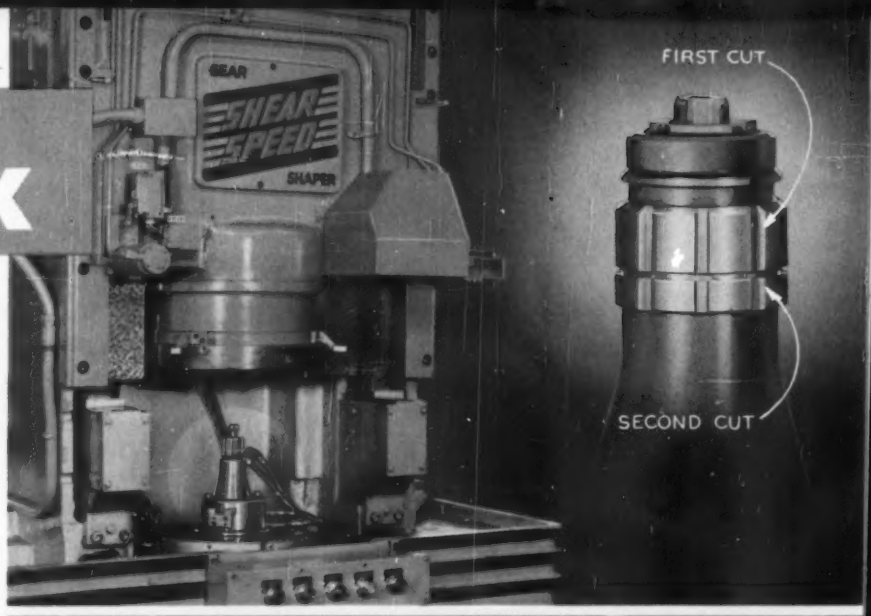
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
*IN CANADA: COLONIAL TOOL CO., LTD.*

*This Month's*

# GEAR PIX

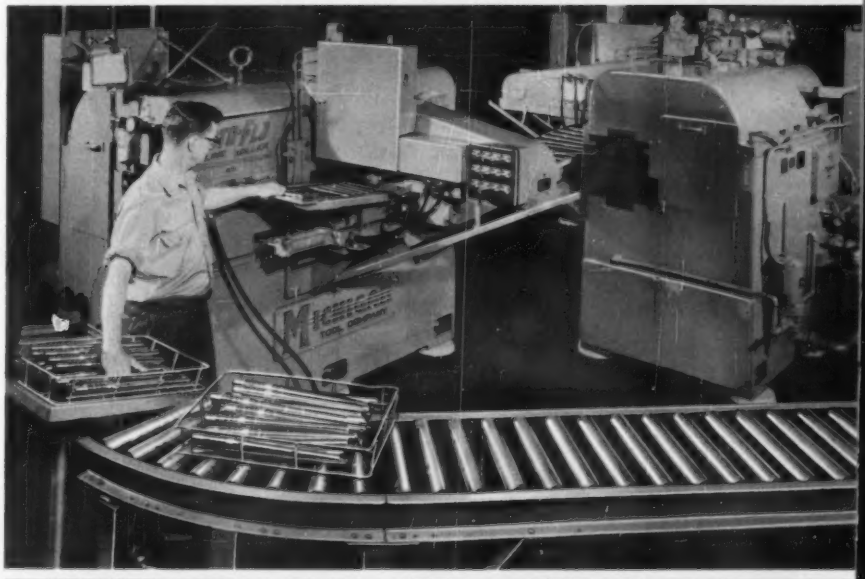
## CUTS TWO PD's IN ONE SETUP WITH SAME TOOLS ▶

A new two-stage Shear-Speed gear shaper does the job if you have a part (such as a two-step clutch) requiring two different pitch diameters. It eliminates second setups. The two sets of teeth are cut in sequence (the deeper teeth first) with the machine cutting head locked in two different positions. Differential tool feed takes care of the PD's. Work cycle is automatic. All Shear-Speeds in the 1800 series can be so modified. We'll be glad to fill you in on details.



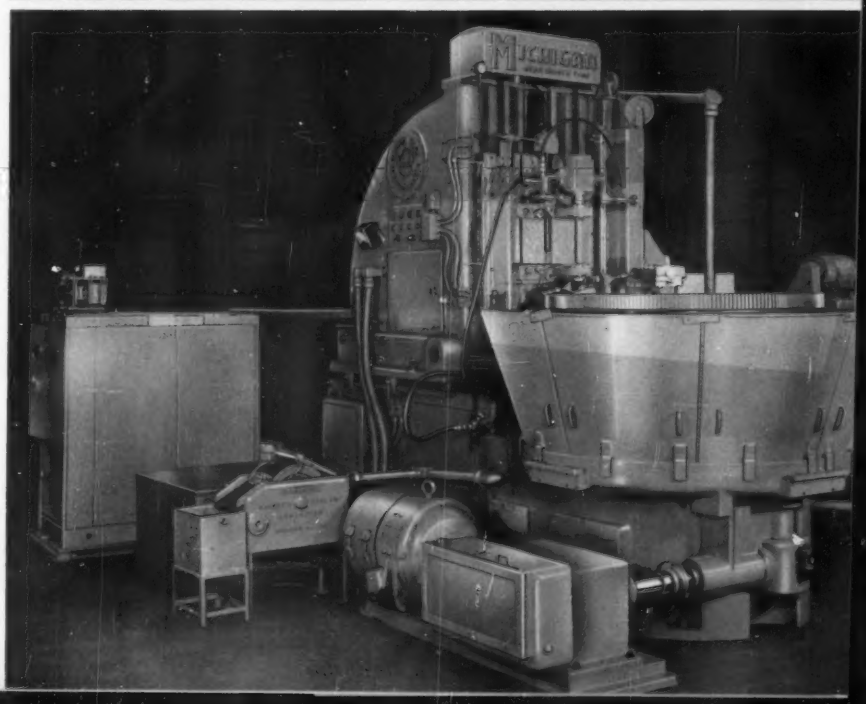

## 285 SHAFTS PER HR TRI-SPLINED BY "CHIPLESS MACHINING" ▶

Three different involute splines are cold formed on a transmission shaft in this trio of Michigan Roto-Flo machines. Transfer devices make the setup fully automatic after the first station. The method also offers long tool life and added product strength. More information is available in our Bulletin RF-55. Write for it.



## HIGHER PERFORMANCE WITH IMPROVED GEAR SHAVER ▶

An improved Michigan Gear Shaver, Model V-48, cuts spur, spiral or herringbone gears up to 4 ft. P.D. It features full-range drive using only two sets of change gears and an integrated spiral pitch checker. Speeds and feeds are completely variable. Literature available soon.

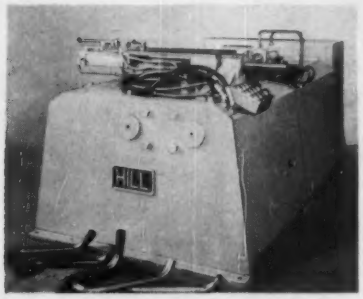



**MICHIGAN TOOL COMPANY**

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
*IN CANADA: COLONIAL TOOL CO., LTD.*

drives, attachment (called Drill-Tru) is available for B & S No. 00, 0, and 2 automatic screw machines using turret driving attachments.

*Jersey Mfg Co, 407 Livingston St, Elizabeth, NJ*




PRESS BENDING MACHINE of horizontal, hydraulic-powered design is built for producing bent ferrous or non-ferrous tubular parts in which two or more bends of varying angles must be in accurate relationship. Accuracy of bend relationships is assured by clamping one end of work and holding it stationary while a bend is produced on the other end by press ram and wiper die assembly. A 1000-psi hydraulic system powered by a 30-hp motor and 40-gpm pump operates unit—*Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich*

## Weld Inspection Equipment

KRH-3D portable unit provides source of current for inspecting welds for lack of penetration and fusion, thermal cracks both in weld and parent metal, and other defects. Unit furnishes both half-wave direct current for locating sub-surface defects, and alternating current for finding cracks open to the surface.

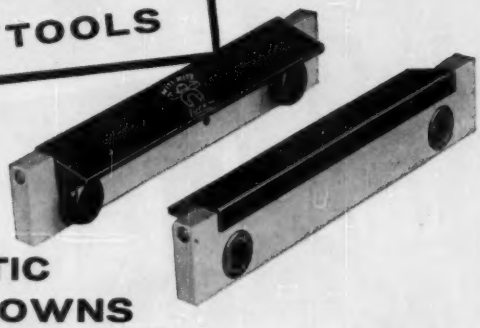
Additional Magnaflux equipment includes YM-5 and Y-5 Yoke Kits for detecting cracks open to the surface, and a spray-on fluorescent penetrant method designated the ZA-43 Zyglo Test Kit.

*Magnaflux Corp, 7300 West Lawrence Ave, Chicago 31, Ill*

**Light-duty slip coupling,** designated L2, for directly connecting two shaft ends, features metallic friction plates and is available with bore dimensions of ½, ⅝, and ¾-in. dia in either member. Type 323 with disc spring assembly has max torque of 9 ft-lb. Type 323A has coil springs

(Continued on page 213)

NEW LUFKIN TOOLS



MAGNETIC HOLD DOWNS

A new, time-saving idea in hold downs — faster, easier and more convenient. Attaches instantly and holds to vise jaws in any position without use of shims, blocks or parallels.

Clamping edge is 3/32", will hold very thin work. Backs are tapered, forcing the work downward as the vise jaws close. A flat spring tab keeps the hold down in a horizontal position until pressure is applied.

MAGNETIC BASE HEAVY DUTY Surface Gage

A large, rugged surface gage and indicator holder. Increased base size prevents rocking . . . larger, stronger magnets permit use with lug back and other heavy indicators and attachments.

The two heavy duty magnets recessed into the solid aluminum base are completely isolated from the spindle and other parts to avoid transmission of the magnetic pull. Polarity of the magnets is controlled by a king size on-off switch that turns the magnetic pull to full on . . . full off . . . or to any intermediate point to make minor adjustments in position. Ground and lapped, contact face has a V-groove, adapting it for use on cylindrical surfaces.

New design scriber has a removable, long-wearing carbide tip which can be reversed to protect the tip from damage when not in use.

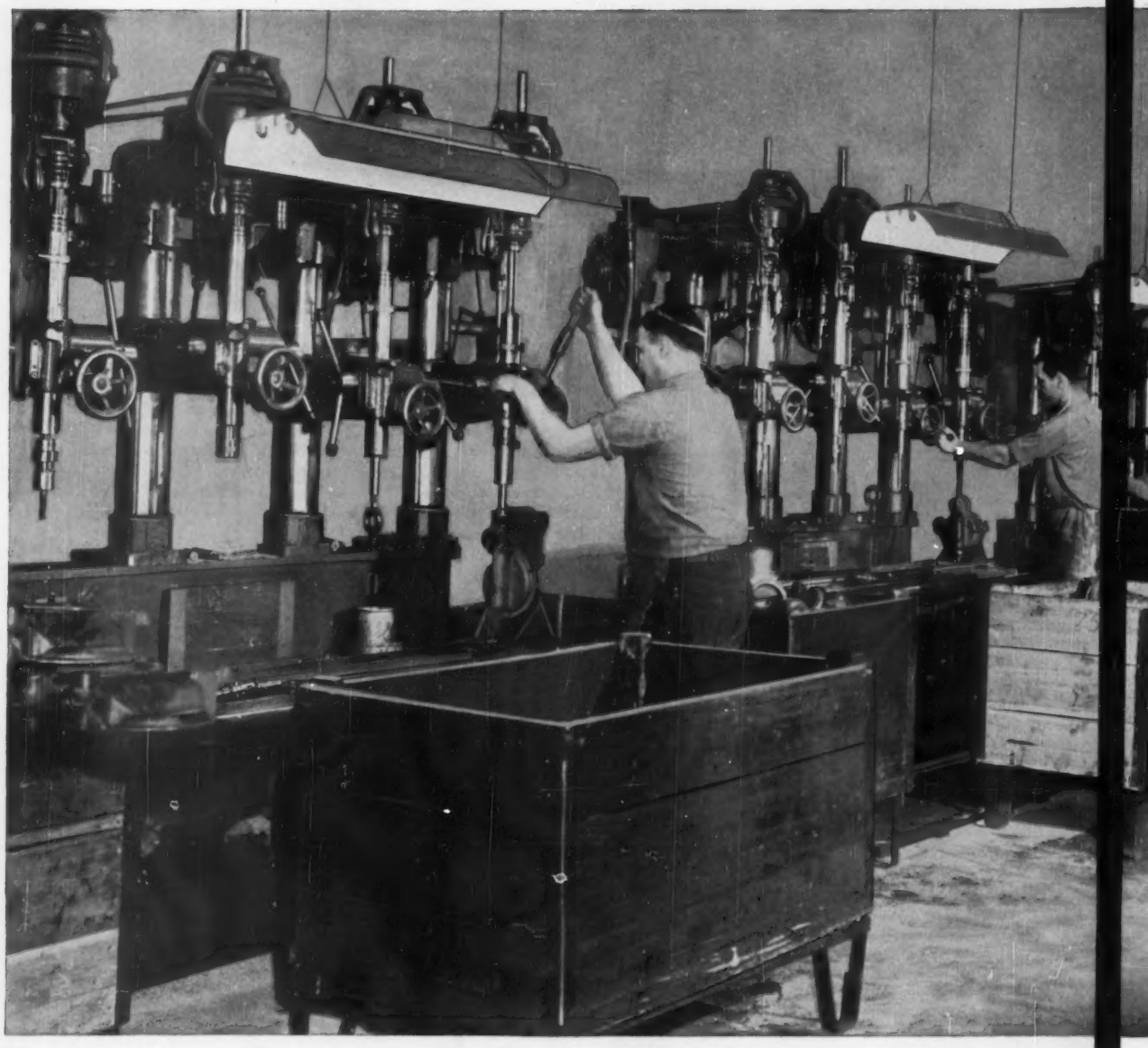
Rugged, rocker arm and large diameter fine adjustment screw permit final, precise adjustments. 9" and 12" spindles, swivel indicator attachment, indicator holding rod, and scriber with reversible carbide tip are included. 18" spindle also available.

MITI-MITE MAGNETIC BASE TOOLS CATALOG

Send for this new 12 page illustrated catalog today. Contains full information on the complete Lufkin line of magnetic base tools.

BETTER MEASURE WITH LUFKIN
TAPES • RULES • PRECISION TOOLS
THE LUFKIN RULE COMPANY, Saginaw, Michigan 478

IT PAYS TO USE YOUR INDUSTRIAL DISTRIBUTOR
. . . He offers emergency 24 hour service

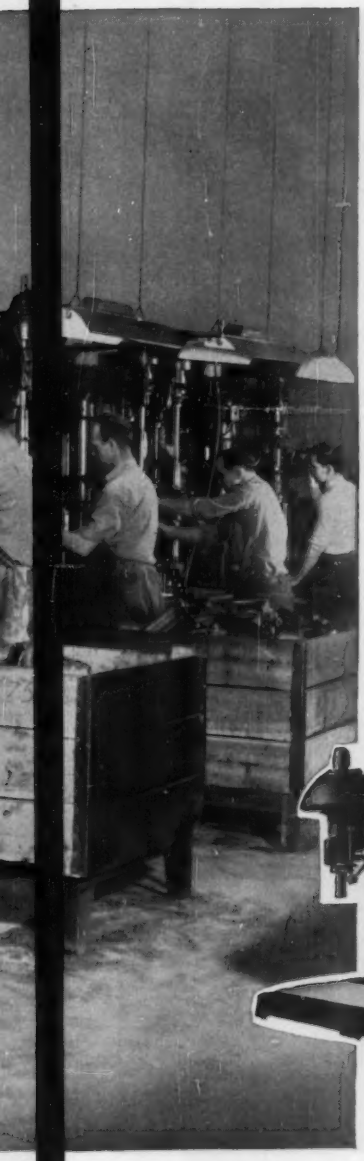


# "BUFFALO" CAN SPEED UP YOUR TOUGHEST

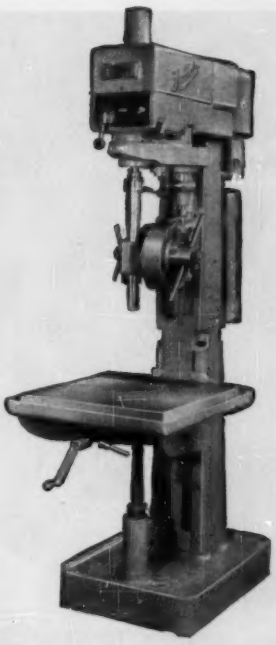
**COMPLEX HIGH-CAPACITY DRILLING, TAPPING OPERATIONS FLOW SMOOTHLY** — with a line of "Buffalo" No. 22 Drills like that above, turning out liquid meters at a high rate. Each operator handles 2 to 4 setups without stopping for adjustments, and each spindle has both power and sensitive feed. Note that all controls are easily reached — these giant 96"-high machines handle as easily as small sensitive drills, yet have 1¼" capacity in mild steel! Hand-scraped ways, husky 5.5" dia. columns, precision 6-spline spindles over 1" in least diameter. Write for Bulletin 2989G and see how these quality machines could be increasing your output and cutting costs.

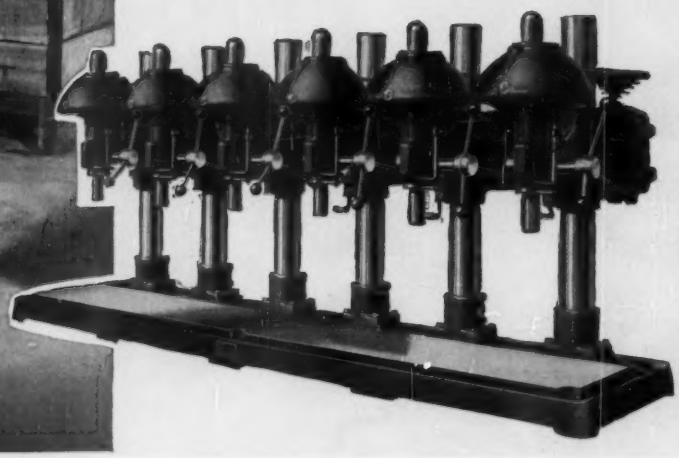
ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

DRILLING • PUNCHING • SHEARING • BENDING



**CHANGE DRILLING SPEEDS WITHOUT TIME-OUTS** and enjoy the smoothest operation in drill history with the great new "RPMster"! Its gearless drive provides instant, infinite spindle speed changes between 100 to 550 RPM's and 500 to 3000 RPM's. Here is the really versatile machine for uninterrupted work flow through its entire capacity range of drilling, reaming and tapping. And the "RPMster" offers every other feature for accuracy and convenience — "Buffalo" all-geared power feed, back gearing, easy-action table-raising screw, hand scraped ways and vibration-free operation. Write for details and a demonstration of the "Q" Factor* built into this precision machine.





**MULTIPLE OPERATIONS — HEAVY PRODUCTION UP TO 1"**—"Buffalo" No. 18 Drills are offered in 19 models to fit your operation exactly — everything from single spindle bench or floor models to 6-spindle units for multiple operations on fixed setups — plus a full range of accessories. These are powerful, rigidly built machines, designed for easy adjustment and operation. Their 6-spline alloy steel spindles turn smoothly and without deflection on two sets of precision ball bearings. Write for Bulletin 3123.

**The "Q" factor — the built-in Quality which provides trouble-free satisfaction and long life.*

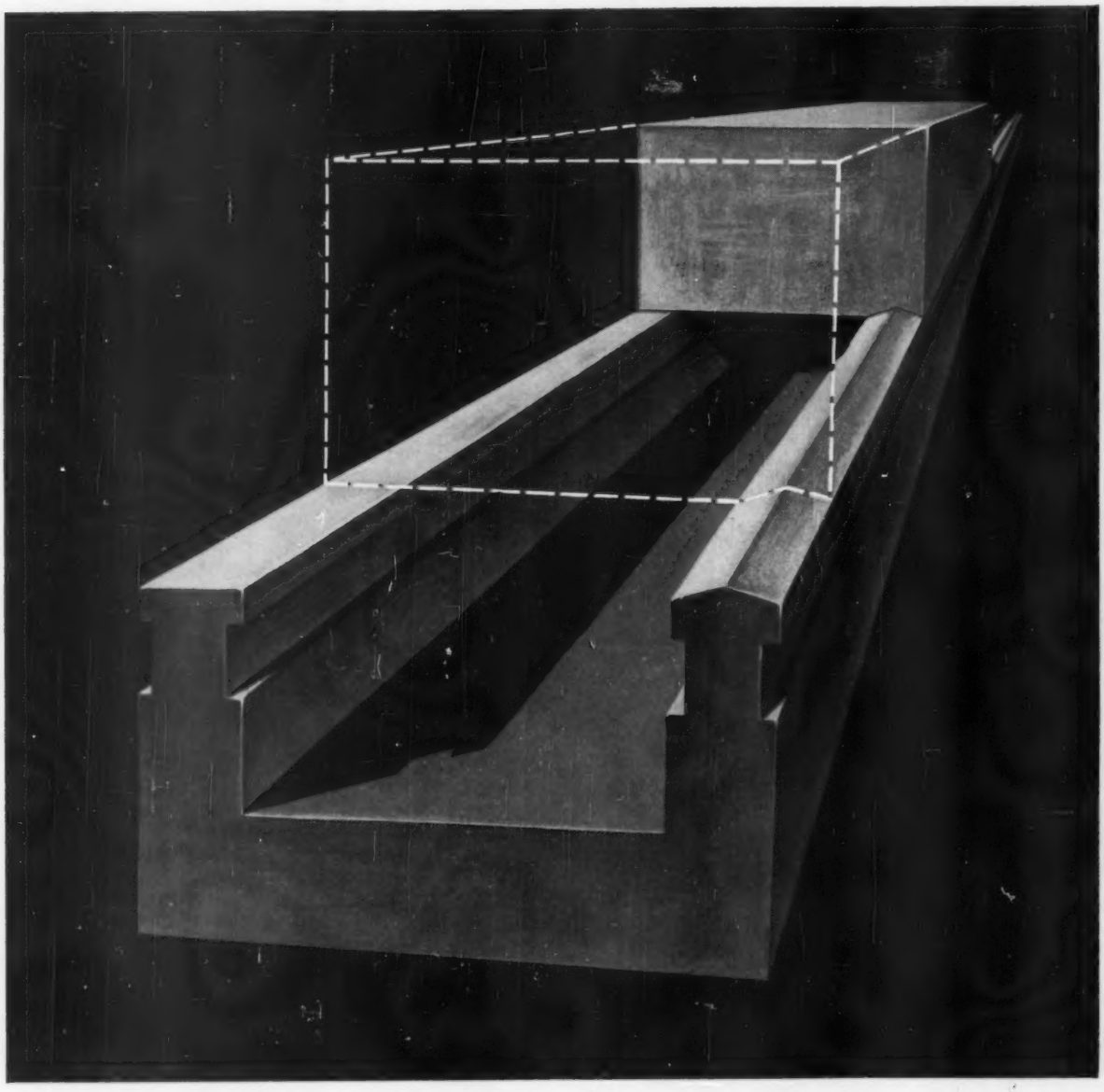
# DRILLING OPERATIONS

**SMALL JOBS UP TO ½"—OR CONTINUOUS PRODUCTION** — The "Buffalo" No. 15 Drill has the adaptability and the stamina for both! Choice of 15 single and multiple spindle models and arrangements, full selection of accessories. Quick, handy adjustments and fatigue-free operation. A full-time production machine, too, with its 6-spline ball bearing spindle and overall husky construction. Write for Bulletin 2963G — there's a "15" tailor-made for your operation!

**BUFFALO FORGE COMPANY**

509 BROADWAY • BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



# for smooth, steady sliding way action

Febis K lubricants – specially formulated to prevent the irregular, stick-slip motion of slow-speed sliding ways in machine tools – are equally effective in higher speed operations. The special composition of Febis K lubricants gives them the unusual property of providing lower *static* friction than *sliding* friction. As a result, moving parts, starting with a low force, will not jump ahead. Febis K lubricants provide smooth, steady sliding action...assure better precision work. Febis K lubricants also help reduce wear because of their strong adhesion to sliding surfaces. And they have mild EP and rust-preventive properties. Febis K lubricants are available in *two* grades: *Febis K-53* – with the right viscosity for small- and medium-size machines; *Febis K-73* – for heavier machines and more heavily loaded machines. Both Febis K lubricants have passed the Cincinnati Milling Machine Company's stick-slip test and have been checked and approved by the Bijur Lubricating Corp. for use in their automatic lubrication systems. For further information contact your nearest Esso Standard Oil Company Division Office: Boston; Pelham, N. Y.; Elizabeth, N. J.; Bala-Cynwyd, Pa.; Baltimore; Richmond; Charlotte; Columbia, S. C.; Memphis; New Orleans.

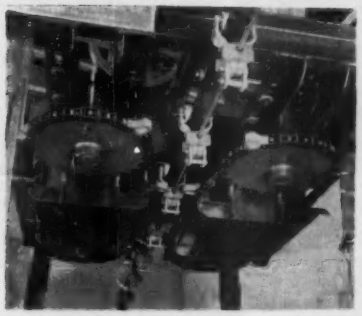
FOR BETTER RESULTS

# FEBIS K

Esso

PETROLEUM PRODUCTS

to provide friction plate pressure, and is recommended for applications calling for torque of 2 ft-lb or less.
*Hilliard Corp, 100 W Fourth St, Elmira, NY*

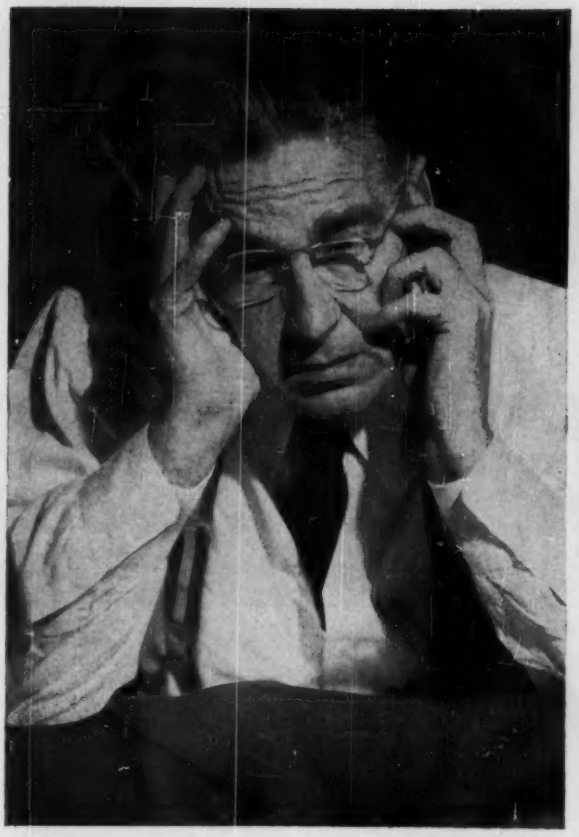


## Caterpillar Drive for Cable Conveyor Increases Load Capacity

Caterpillar drive for Bush-Lock cable conveyors allows large-radius traction wheels to be applied to straight conveyor runs. As a result, sizable loads can be handled on close hook centers. Special dogs engage cable and trolley with equal pressure from both sides, equalizing side thrust. Large-radius traction wheels guide cable around idler corners and permit clearance of large packages.
*E W Buschman Co, Clifton & Spring Grove Ave, Cincinnati 32, Ohio*

**Straight-shank end mills** with carbide-tipped insert blades are offered in nine sizes. Diameters range from 1 to 2½ in.; length of cut is 1½ or 2 in.; shank lengths vary from 2¼ to 3¼ in.; and shank diameters range from 1 to 2 in. Right-hand cut is standard. Blades are held in cutter bodies by replaceable serrated wedges; for quick adjustments, cut-

*"Lucus, during coffee break everybody will drink coffee!"*

send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

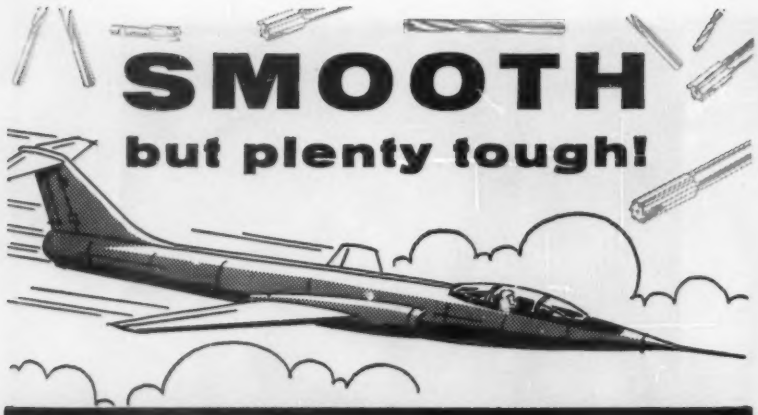
1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

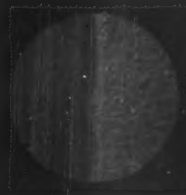
*Designers and manufacturers of* JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*



SMOOTH
but plenty tough!

WENDT-SONIS tools cut
fast and clean . . . stay sharp

The difference is in the finish!
All Wendt-Sonis drills, reamers, counterbores and other round tools are 30% smoother by profilometer readings. Flo-Finish, an extra operation applied after final grinding, practically eliminates grinding marks.



30% smoother Flo-Finish reduces chip friction — permits faster chip flow away from cutting edges — faster feeds and speeds. Lower chip friction also means less tool-damaging heat with a resulting increase in tool life. In addition, less power is required, and work finish is improved — in some cases by an average of 50%.

Micro-photograph (right side) shows how Flo-Finish eliminates grinding marks.

For detailed information on Wendt-Sonis tools, for competent technical assistance on tooling problems, see your Wendt-Sonis distributor's salesman.

*Send for free 94-page Catalog No. 55—Address Dept. AM-557*

WENDT-SONIS COMPANY

Hannibal, Missouri • Rogers, Arkansas




ter diameters can be increased in 1/32-in. increments by moving blades to adjoining serration.

*Goddard & Goddard Co, 12280 Burt Rd, Detroit, Mich*

**Face milling cutter wedge** of Eager Beaver line of cutters has been redesigned to accept solid carbide or carbide-tipped blades in same cutter body. One cutter may be used to cut all types of materials, steel, cast iron, brass, bronze, aluminum and magnesium.

*Beaver Tool & Engineering Corp, Royal Oak, Michigan*

**Portable coil racks** designed for heavy duty are built to occupy minimum floor space yet permit more stock tonnage to be stored. Units are custom built to any size and weight specification. Cradle is so arranged that individual coils can be removed from rack without disturbing balance of stock in rack.

*Palmer-Shile Co, 16019 Fullerton, Detroit 27, Mich*

## Air Cylinders

Toolmor units give a full line-pressure power thrust with heavy hardened steel piston. Square and parallel sides simplify tooling installation; universal mounting permits either horizontal or vertical thrust use.

Cylinders are available with standard, ball, swivel, threaded, or tool blank piston ends, in various length strokes beginning with ¾ in.

*Burklyn Co, 3429 Glendale Blvd, Los Angeles 39, Calif*

*"I'm afraid you fellows haven't quite got the ideal"*

## Free Literature

To order any of these bulletins, please use cards at start of this setcion—page 176c.

### MACHINES AND ATTACHMENTS

**34** DRILLPRESSES — *Rockwell Manufacturing Co, Delta Power Tool Div, 470 N Lexington Ave, Pittsburgh 8, Penna.* 12-page illustrated bulletin describes and gives specifications for floor and bench, single and multiple spindle models in several basic sizes, including 17, 15, and 14-in. units.

**35** C-FRAME PUNCHES AND SHEARS —*Williams-White & Co, Moline, Ill.* 8-page Form 74 contains illustrated descriptions of mechanical units in various capacities and throat depths, single or double end, with plain or architectural-type tables. Tools and attachments covered.

**36** PRECISION JIG BORER — *Opto-Metric Tools, Inc, 137 Varick St, New York, NY.* 8-page catalog 82-4 gives detailed information on Leitz unit with 6×6-in. measuring range, optical setting in 0.00005 in., circular setting in 10 sec. Design features pictured and described; operational principle discussed.

**37** PORTABLE SHAPE-CUTTING MACHINE—*Air Reduction Sales Co, Div of Air Reduction Co, 150 E 42nd St, New York 17, NY.* 8-page illustrated catalog ADC 660B describes advantages and applications of Airco's No. 4 Monograph. Features, cutting range, weights, dimensions covered.

**38** 65-IN. HORIZONTAL INDEXING MACHINE — *Hartford Special Machinery Co, Hartford, Conn.* Literature illustrates and describes standard machine components available for assembly of automatic unit.

**39** GRINDER TOOLS—*Rockwell Manufacturing Co, Walker-Turner Div, 400 N Lexington Ave, Pittsburgh, Penna.* 8-page illustrated bulletin gives data on "light heavyweight" machine tools, including a surface grinder that can be used as chip-breaker or tool and cutter grinder; floor and bench model tool grinders; workholding accessories.

### TOOLS AND ACCESSORIES

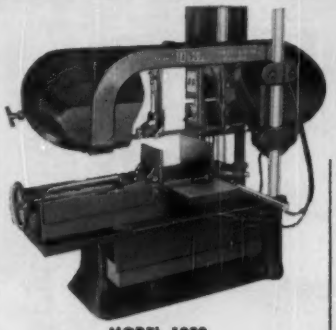
**40** DIAMOND DRESSING TOOLS — *Craine-Schwartz Diamond Tool Co, 8100 Lyndon, Detroit 38, Mich.* Folder pictures and describes standard tools for general grinding operations, radius forming work, form dressing steps and other irregular profiles, reproducing root sections of jet blades and buckets, as well as a variety of multiple stone and diamond impregnated tools.

**41** POWER BRUSHES—*Osborn Manufacturing Co, 5401 Hamilton Ave, Cleveland, Ohio.* 4-page illustrated folder describes advantages and applications, specifications and characteristics of the Matic brush for production use, and the Tufmatic, designed for stronger action in removing burrs and scale.

**42** ADJUSTABLE INDICATOR GAGE —*Ellstrom Inc, 22033 Beech Rd, Dearborn 8, Mich.* 4-page bulletin lists prices, specifications, and suggested uses for the Shalo-Chek, available in three standard models. Applications illustrated and explained, including use for checking shallow dimensions at the machine without disturbing setup.

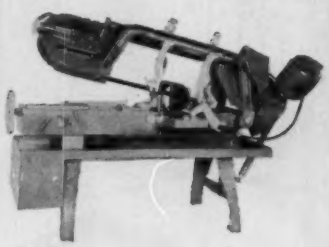
**43** AIR SANDER—*Sundstrand Machine Tool Co, Magnetic-Pneumatic Div, Rockford, Ill.* Bulletin 800-1 provides information on Model 800 that weighs 3 lb. operates at 6000 cycles. Applications illustrated.

**44** WIRE TWISTER—*Ralph C Robinson Co, 2516 Crosby Way, North*

**MODEL 1200**

A rugged, horizontal band saw for heavy duty production cutting, with a completely automatic cutting cycle. Capacity: 12" x 16". Wet cutting standard.

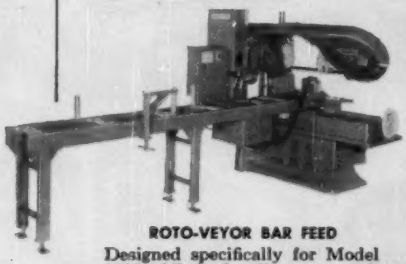


**MODEL 1000**

Big capacity production saw, using 1" blades for greater accuracy and efficiency. Capacity: 10" x 16". Shown with optional wet cutting system. No. 8 and Model 600 are similar.

**MODEL 49-A**

Dual purpose economy band saw shown as a horizontal cut-off machine. Raise cutting head to upright position—it's a vertical band saw. Capacity: 3½" x 6".



**ROTO-VEYOR BAR FEED**

Designed specifically for Model 1200. All feed rollers powered. Not shown is the Wells-O-Bar Feed Master, available for Model 1000, No. 8 and other pivoted type machines.

# WELLS-QUALITY CUT-OFF SAWS

## . . . designed and engineered for the "VALUE BUYER"

Take a good long look at value . . . it's an important factor in the fight to stem rising costs.

For over 30 years, Wells Manufacturing Corp. has engineered into every horizontal metal cutting band saw, a combination of practical value features designed to give you the most for each dollar you spend. Extra rigid, heavy duty construction; "constant load" blade tensioning; safety switches with overload protection . . . these are just a few of the value-packed features that help you do a better cutting job at a lower unit cost.

Put Wells to the test . . . compare them with other makes . . . it's the best way to satisfy yourself of their OUTSTANDING PERFORMANCE and BIG VALUE.

*Ask your Wells Distributor for full information and assistance.*

| | Model 1200 | Model 1000 | No. 8 | Model 600 | Model 49-A |
|---|---|---|---|---|---|
| Capacity, Rectangular | 12" x 16" | 10" x 16" | 8" x 16" | 6" x 13" | 3½" x 6" |
| Capacity, Rounds | 12¾" | 10" | 8" | 6¾" | 3½" |
| Speeds, Ft. Per Minute | 60, 115<br>200, 300 | 50, 100<br>175, 275 | 50, 100<br>175, 275 | 50, 90<br>160, 250 | 54, 100<br>190 |
| Motor Size | 1 H.P. | ¾ H.P. | ½ H.P. | ½ H.P. | ¼ H.P. |
| Blade Size | 1" x 13'6" | 1" x 11'6" | ¾" x 11'6" | ⅝" x 8'2½" | ½" x 5' |
| Height to Top of Bed | 24¼" | 25½" | 25½" | 25½" | 24" |
| Floor Space | 44" x 78" | 24" x 72" | 24" x 72" | 21" x 50" | 16½" x 38" |
| Shipping Wt. (Approx.) | 1950 Lbs. | 705 Lbs. | 650 Lbs. | 425 Lbs. | 145 Lbs. |

Wells saws

Wells®

*The Pioneers of Horizontal*

**METAL CUTTING BAND SAWS**

**WELLS MANUFACTURING CORPORATION**

505 Roosevelt Road, Three Rivers, Michigan

MURRAY WAY "PROVED RIGHT" EQUIPMENT AND ENGINEERING EXPERIENCE ARE THE ANSWER TO YOUR POLISHING, BUFFING AND GRINDING NEEDS.
Whether you need a single, standard polishing head or a specially engineered, fully automatic production line with all the trimmings, Murray-Way can do the job better, more reliably, for greater operating efficiency.
You are invited to consult our engineering staff about your finishing problems.
MURRAY WAY CORPORATION
P. O. BOX 180, MAPLE ROAD EAST BIRMINGHAM, MICH.
Polishing, Buffing, Grinding, Filtering Equipment
that automatically cuts your costs.

## Free Literature

*Sacramento 15, Calif.* 1957 catalog and price list covers the M-80 unit. Operating details illustrated, specifications provided.

### HEAT TREATING AND WELDING

**45** CONTROLLED ARC POWER SUPPLY—*Metal & Thermit Corp, Rahway, NJ.* 4-page illustrated brochure describes rectifier-type welder that supplies current at preset constant voltages to assure more uniform bead shape. Equipment is adaptable to various automatic and semi-automatic welding requirements.

**46** GAS BURNERS — *Selas Corp of America, Dresher, Penna.* 4-page bulletin SC-1001 gives details on Series PRS unit which produces a sharp, spear-like heating flame for use in brazing and soldering applications where a high-temp flame covering a limited area is required, using any available fuel gas and air.

### PLANT SERVICE EQUIPMENT

**47** HYDRAULIC DESCALING EQUIPMENT — *Commercial Shearing & Stamping Co, Youngstown 1, Ohio.* 36-page illustrated catalog D57C describes operating principles and features of "Hydra-Jet" equipment for removal of scale from bars and slugs prior to hot working. Specifications given for standard models and components and arrangements used in individually engineered systems.

**48** AIR AND VACUUM PUMPS—*Leiman Bros, Inc, 102 Christie St, Newark 5, NJ.* 16-page catalog 1957 gives data on rotary positive pumps, gas boosters, and air motors. Includes construction details, dimensions, capacities, new performance curves, installations, plus line of accessories.

**49** PORTABLE VACUUM CLEANER—*US Hoffman Machinery Corp, 105 Fourth Ave, New York 3, NY.* 4-page bulletin M-135 presents detailed, illustrated description of Hoffco-Vac Model 35; weighs 650 lb, is 32 in. wide, permitting use in narrow aisles. Equipment is powered by a 5-hp motor plus a V-belt driven exhauster.

**50** 4000-LB FORK TRUCK—*Clark Equipment Co, Industrial Truck Div, Battle Creek, Mich.* 6-page brochure gives details on Clarklift-40 with swing back hood, self-adjusting brake, adjustable upright assembly, removable counterweight.

**51** MOTOR-DRIVEN TROLLEY—*Yale & Towne Manufacturing Co, Yale Materials Handling Div, 11,000 Roosevelt Blvd, Philadelphia 15, Penna.* Illustrated 4-page bulletin 1507 describes Rail King Tractor for use with monorail hand and electric hoists up to 3-ton capacity. Discusses features of electric-powered unit; includes dimensions, travel speeds, and performance curve.

**52** MATERIALS HANDLING EQUIPMENT — *Uhrden, Inc, Tubar Lift Div, Dennison, Ohio.* 4-page bulletin lists specifications and details of electric and manual lifting and stacking equipment. Lift models, 1000 to 3000-lb capacities, are available with fork, platform, or combination lifts. Also covers hydraulic stackers and telescopic lifts.

**53** FLUORESCENT LIGHTING GUIDE BOOK — *Sylvania Electric Products Inc, 60 Boston St, Salem, Mass.* 24-page booklet discusses general advantages, and includes sections on each of the lamp types, starters, lampholders, ballasts, and specials.

**54** CONVEYING EQUIPMENT—*Rapids-Standard Co, 343 Rapistan Bldg, Grand Rapids 2, Mich.* Bulletin LPV-56 describes light-duty Press-Veyor Jr, cleated belt conveyor, to transfer stampings or scrap from press to tote bins. Bulletin MPV-56 covers the Press-Veyor unit which

*(Continued on page 220)*

# PLAN
## FOR TOMORROW'S PRODUCTION TODAY

## .....with MACKLIN "Wheels of PROFIT"

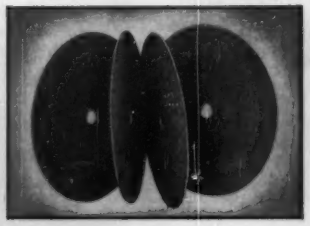
Today, the automated, high speed grinding of new and improved metals calls for higher quality grinding wheels than ever before. Wheels like the Macklin V-8 illustrated above. V-8 is setting new standards of performance in the grinding of cemented carbide tools. It cuts faster with less push, and it's easy on the tools. *Your* management will like V-8's long wheel life, and the way it cuts down operator fatigue.

But, *V-8 is only one of a complete line of* Macklin "Wheels of Profit" for industry. Every Macklin wheel is designed to meet the demands of today's production, is part of a program of constant product development and improvement . . . because planning for tomorrow's production today is our most important job.

***YOUR NEAREST MACKLIN DISTRIBUTOR OR FIELD ENGINEER WILL BE GLAD TO DEMONSTRATE THE MACKLIN WHEEL WHICH IS BEST FOR YOUR PARTICULAR GRINDING PROBLEM. YOUR LETTER OR PHONE CALL WILL RECEIVE PROMPT ACTION.***

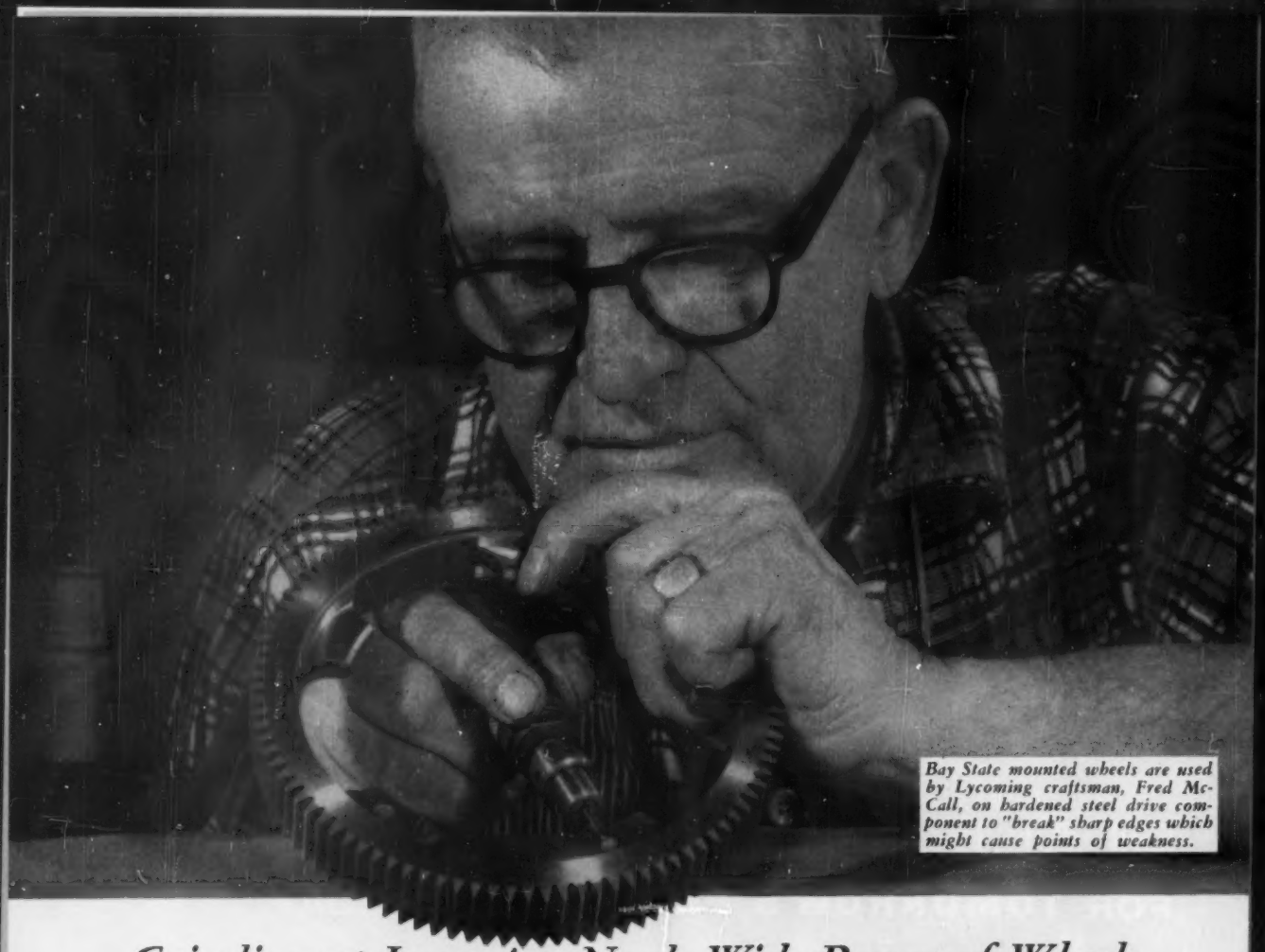
**MACKLIN company**

**Dept. 70, Jackson, Michigan**



***Wheels for . . .***

- Surface Grinding
- Cylindrical Grinding
- Centerless Grinding
- Tool Sharpening
- Wirebound Cylinder Wheels
- Foundry Wheels
- Segmental Wheels
- Cut-Off Wheels



*Bay State mounted wheels are used by Lycoming craftsman, Fred McCall, on hardened steel drive component to "break" sharp edges which might cause points of weakness.*

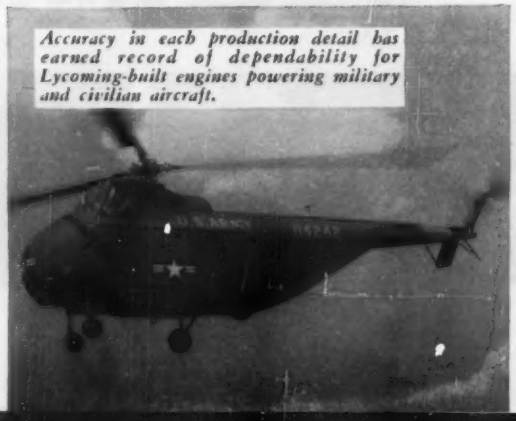
# *Grinding at Lycoming Needs Wide Range of Wheels — Versatile Engineering*

TO the Lycoming Division of Avco Manufacturing Corporation at Stratford, Connecticut, *dependability* in aircraft engines is as important a product as the engines themselves! And precision grinding, in many forms, helps produce this built-in dependability.

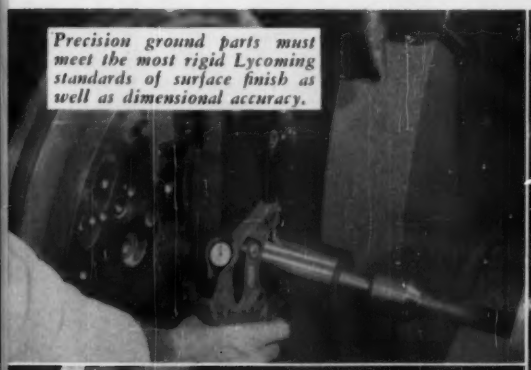
For example skilled deburring of the accessory drive gear component shown on this page is important because sharp edges could set up points of weakness . . . and human life will be at stake.

On these carburized steel parts with surface hardness to Rockwell C, a small spherical wheel of exceptional durability is needed to do the job neatly and precisely. A wheel too soft grooves quickly and leaves a ragged edge, needing another operation to finish it. Bay State specified, and manufactures for this job, a wheel that skillfully combines the necessary hardness with a clean cutting action which leaves no surface burn — also important because all parts must pass 100% acid-etch inspection.

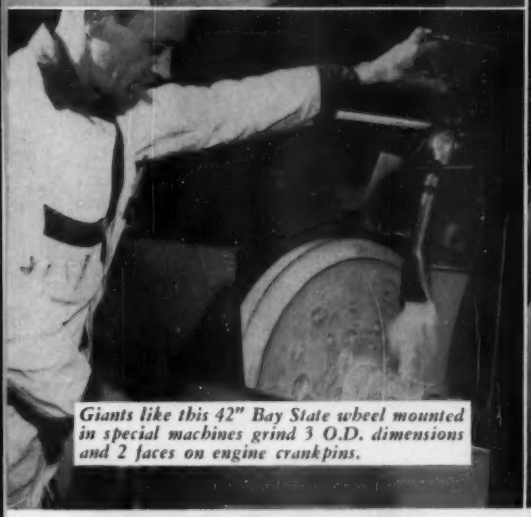
Specifying and faithfully reproducing these efficient small wheels is one important Bay State contribution to the dependability of Lycoming-built engines.



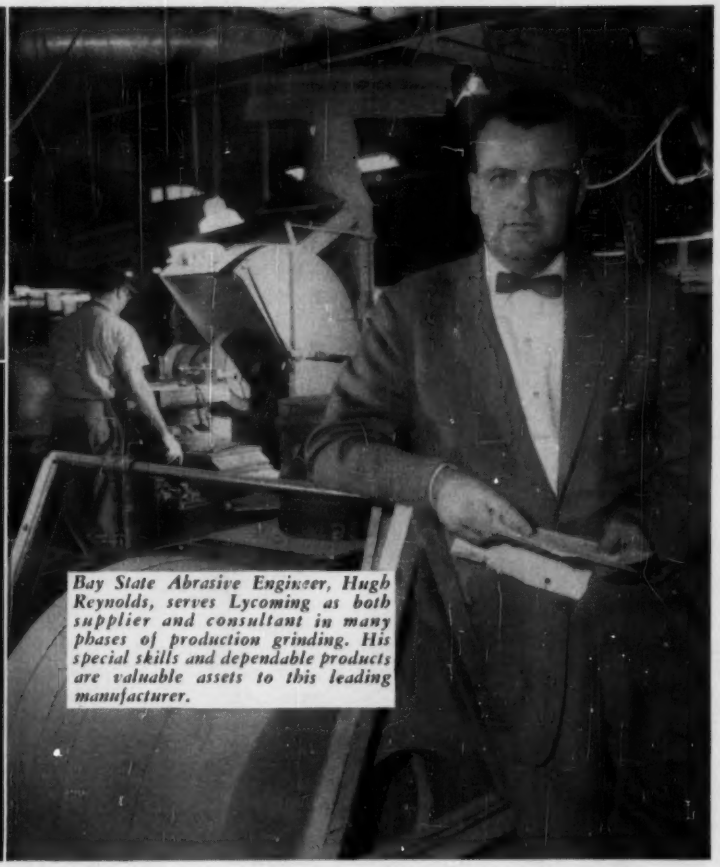
*Accuracy in each production detail has earned record of dependability for Lycoming-built engines powering military and civilian aircraft.*



*Precision ground parts must meet the most rigid Lycoming standards of surface finish as well as dimensional accuracy.*



*Giants like this 42" Bay State wheel mounted in special machines grind 3 O.D. dimensions and 2 faces on engine crankpins.*



*Bay State Abrasive Engineer, Hugh Reynolds, serves Lycoming as both supplier and consultant in many phases of production grinding. His special skills and dependable products are valuable assets to this leading manufacturer.*

In the larger grinding wheel sizes, too, Lycoming depends on Bay State for many critical operations. The multi-purpose cylindrical grinding set-up illustrated above is a typical case.

This special Landis grinder mounts a mammoth wheel, 42" x 6" x 12", specified by Bay State to perform a series of precision grinding operations on engine crank-pins. Three different O.D.'s and two faces are ground on this critical component, removing from .015 to .050 stock. The part made of AMS-6415 nitriding steel is finish ground in the soft state at about 35 Rockwell C. The successful Bay State specification was selected for its ability to produce fine, uniform finish, yet hold its corners for long productive periods between dressings.

At Lycoming and other plants, Bay State engineers are solving grinding problems . . . applying grinding wheels from the smallest to the largest . . . specifying grinding wheels for every purpose, every type of machine. With confidence, call in Bay State through any of its branch offices or distributors.

# BAY STATE ABRASIVES

**Bay State Abrasive Products Co., Westboro, Mass., U. S. A.**

Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.

*Distributors* — All principal cities • In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

BAY STATE ®

WHEELS of PROGRESS

## Free Literature

uses a magnetic field to keep materials on its steeply inclined belt; handles transfer of all iron or steel parts automatically.

**55** BRUSHES — *Osborn Manufacturing Co, 5401 Hamilton Ave, Cleveland 14, Ohio.* 4-page folder on Rota-Master brushes, made in 16, 18, and 24-in. face widths, describes applications including cleaning of conveyor belts, material spreading, dust removal, and metal finishing when used with abrasive compounds. Covers specifications, hp and machinery requirements.

**56** MATERIALS HANDLING MACHINE — *Visi-trol Engineering Co, 9345 Hubbell, Detroit 28, Mich.* 4-page illustrated bulletin C-1056 gives details on Conveymatic Carrousel steel platen conveyors for materials handling, automatic assembling, inspecting, or light machining operations. Includes construction details, sizes, travel speeds, working heights, load capacities, typical setup.

**57** HYDRAULIC POWER UNITS AND TEST STANDS — *J N Fauver Co, 49 W Hancock, Detroit 1, Mich.* 8-page illustrated brochure describes standard and special units, as well as general purpose test stands and those for special application. Engineering data and drawings included.

**58** PUMP SELECTOR CHART—*Barnes Manufacturing Co, Mansfield, Ohio.* Illustrated catalog form 343 gives heads, capacities, and other data on units including gasoline, electric, diesel, and belt-driven; sump, diaphragm, standard, and self-priming models covered.

**59** MATERIALS HANDLING EQUIPMENT—*Elizabeth Iron Works, Box 360, Elizabeth, N.J.* Literature illustrates and describes "Lifetime" line, including ramps, pallet stackers, torque hooks.

## Round Table...

### GOOD BYE, MR MECHANIC

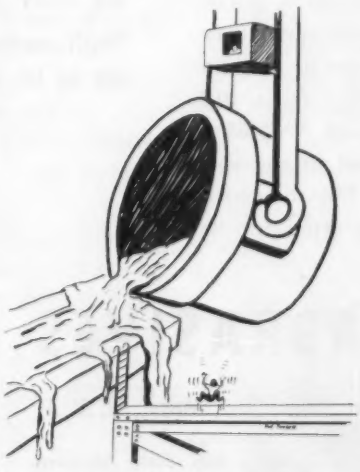
*Do some shop men tend to hold white-collar jobs in too high esteem? Is there a feeling that transfer to such a job will mean quicker promotions, more opportunities to advance in pay and prestige?*

IT IS a grave mistake to neglect the needs of the shop in order to accommodate the conveniences of the drafting department. We read so much these days about the dangers of the future because of the scarcity of men of engineering caliber, but very little do we concern ourselves about the likely scarcity of well trained men who possess that manipulative potential, better known as skill, and the mental acumen so necessary to think their way through constructive difficulties. We are going to need more than ever the services of skilled men with trigger brains in the machine shops of the future—more so than at present because the higher degree of automation is taking over pretty fast. Without the services of the first-class mechanics, who are adaptable to changes, there is going to be a pretty serious bottleneck which will strangle our progress toward maintaining the technical superiority which we now hold.

The false idea that the all-round mechanic is being relegated to the torch because of the influx of specialization is nothing short of idiotic. Specialization is necessary in order to gain efficiency in production and, without a doubt, the all-round mechanic is the foundation for this specialization. We must have good toolmakers in order to create the tools for the specialist to use if he is going to make the most of his specialty. We need all-round machinists who are capable of producing new machinery as well as to overhaul them in the event of breakdowns and deterioration caused by the strain of high production.

This seems to be a long way around answering the question propounded by the editor, about the relative values of the need of replacements in the engineering department and the shop, but the needs are also contingent upon the possible dangers confronting us should we neglect one in order to benefit the other. You can't rob Peter to pay Paul and come out with a well-balanced organization.

It is regrettable that industry doesn't concern itself more about using its influence (and it would



*"When! Dammit! When!"*


*(Advertisement)*

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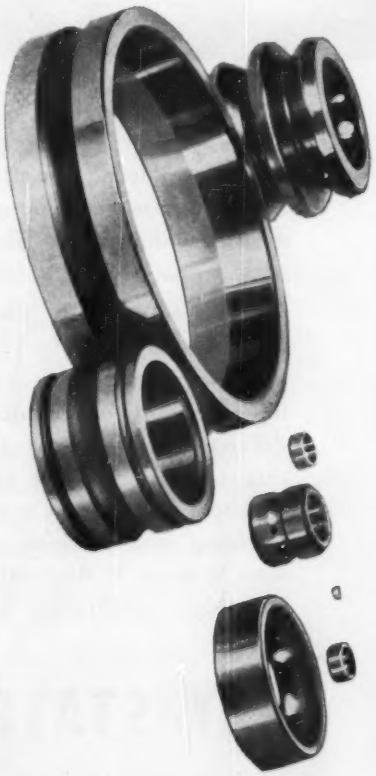
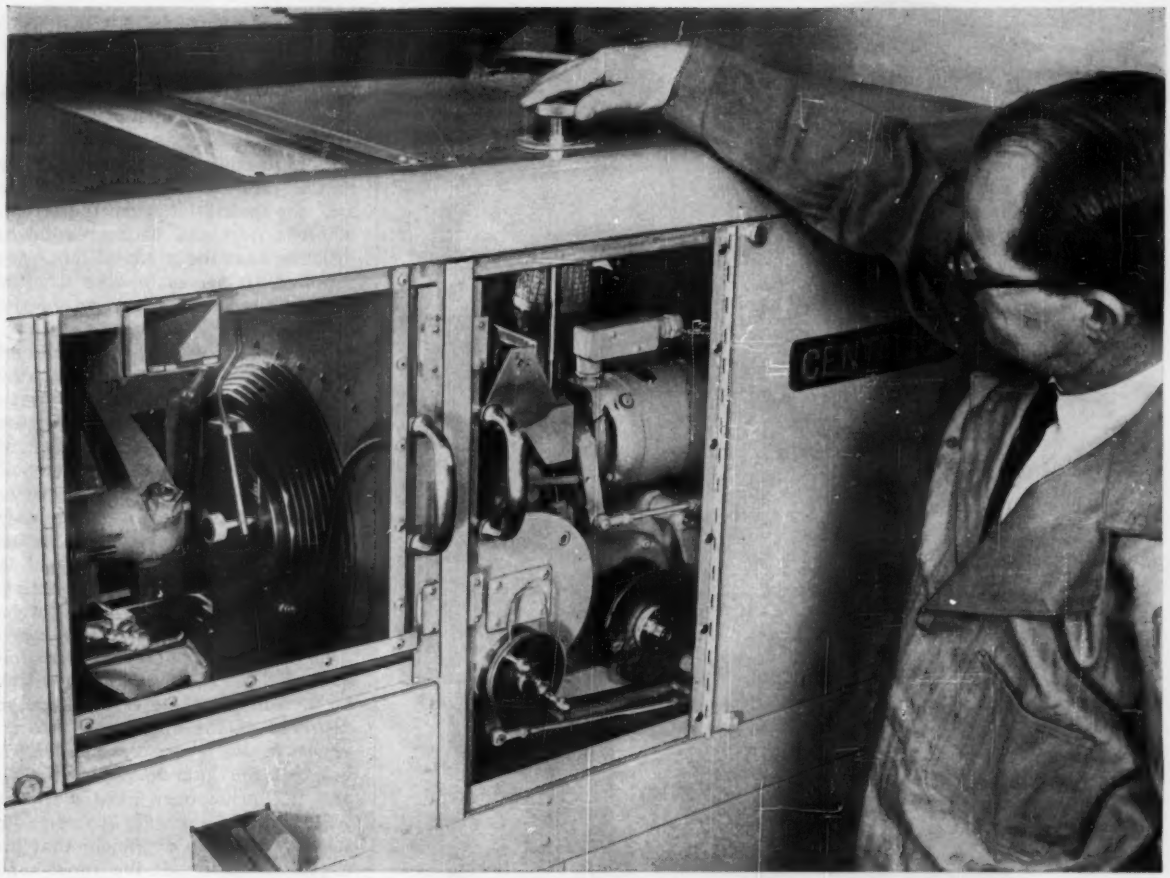
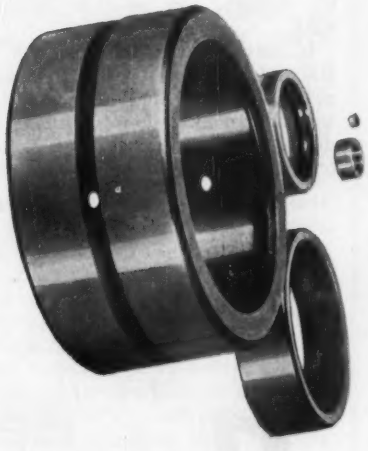




# Fastest Precision Internal Grinder Ever Built!



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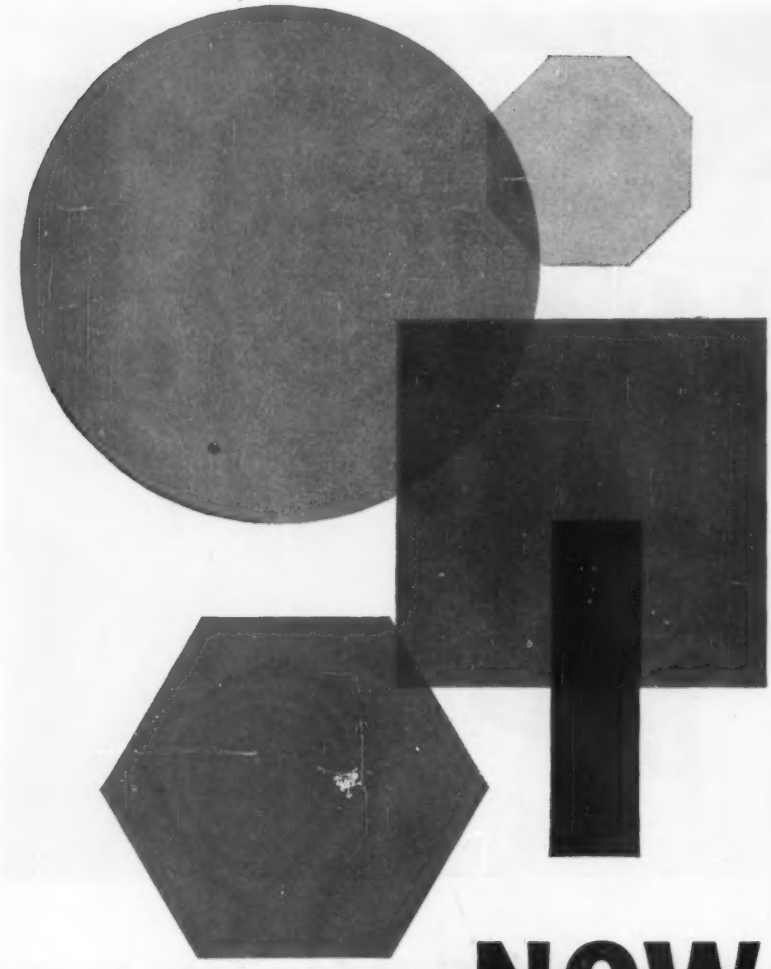

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be a mighty powerful one if it were pressed into the present necessity) in affairs of vocational education. Industry, being the basis of the nation, hasn't taken enough leadership in letting its needs be known to the powers in education. To me it seems that it concentrates on the product and the profits it gets therefrom, whereas it should be aggressive in insisting that the needs of labor are supplied. It seems to take what is handed to it and has to make the most of it.

Getting on with the Holland conundrum I might say that the man's desire to work in the drafting room is probably inspired by his desire to climb the ladder of success wherein he sees greater possibilities. While there are opportunities in the production end he may feel that with serious effort on his part he can accomplish his goal in less time if he entered engineering. If he is made of the right stuff he will certainly gain considerably from the course offered by the company. No youngster, no matter if he be born in a packing case, should be deprived of the opportunity to advance in his chosen profession. If he's got the guts to apply himself and not gripe over hard work he will make the grade. It seems in this day of many diversions that the opportunities to gain the upper hand over his fellowmen are greater than ever. Cold blooded? Not at all. In this world of competition it is every man for himself as far as getting ahead by his own effort is concerned, provided he doesn't do it by stepping on another fellow's neck.

It may be that the selection of Holland was because of the chap's potential which had been detected by Personnel. No doubt he made his desire known at some time or another and, when the need arose for

a replacement, he was seriously considered.

I could have been content at the bench when I was a young squirt but I saw a greater opportunity for me were I given the chance to prove my worth as a draftsman and designer of tools. There are legions who have taken advantage of the drafting room to get ahead faster than would have been the case were they to have stayed in the shop. Some fellows like the clean environment to work in and lose no time in making their desires known. Ever hear of anyone who applied for a transfer into the shop from the drafting room?

It certainly would be a good thing if some of the draftsmen would get into a shop for a while because they certainly would become better draftsmen as a result of the practical experience. I knew of one chief who wouldn't hire a man for his department unless he had some shop experience regardless of the degrees he held from college. From my way of reasoning I wouldn't call him a crackpot by any means.

Jack Gleason
*Glendale, Calif*

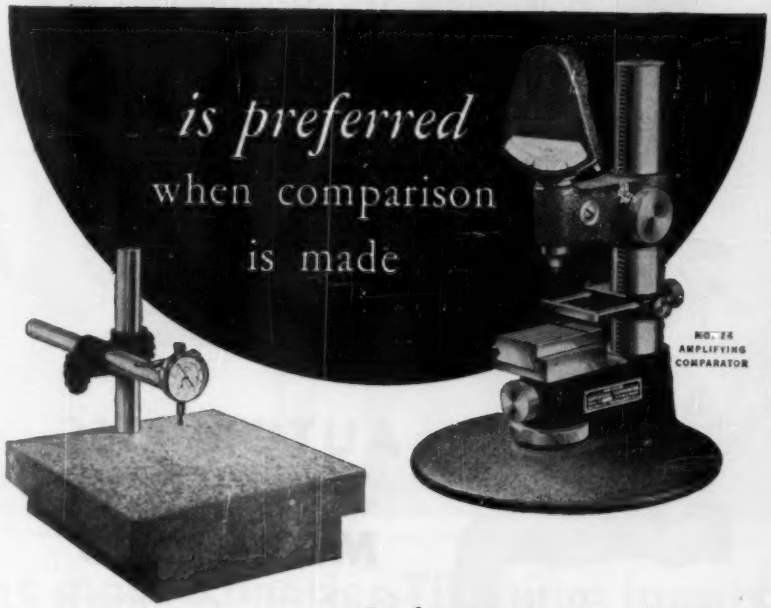
THE SUPERINTENDENT of a well-known manufacturing plant where I had the privilege of working some time ago had the profitable vision of a practical man. He decreed that any need of men in the engineering department should be supplied by those men who, at the recommendation of the foreman, had proven themselves in the shop.

If I interpret your question "Do some shop men have too much respect for white-collar jobs" I might say that some hold a high regard for those in the higher level of endeavor in a sense that they look up to them with a certain respect, but when an error is made by any of those so-called theorists they take particular delight in making their amusement known. Some feel inferior in that they can't wear clean clothes as the others do, while others spend some time in dreaming of the day when they can be on an equal level and share their isolation.

There are workers who seem to be entirely satisfied with conditions as they find them, who are satisfied with their lot and have no desire whatsoever to be advanced to engineering. Then again we have the ambitious element who are not satisfied, and see a greater future in


AMES

*is preferred*
when comparison
is made

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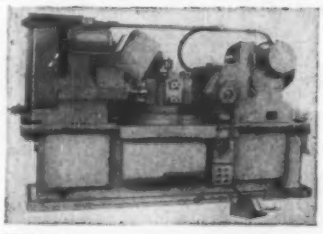

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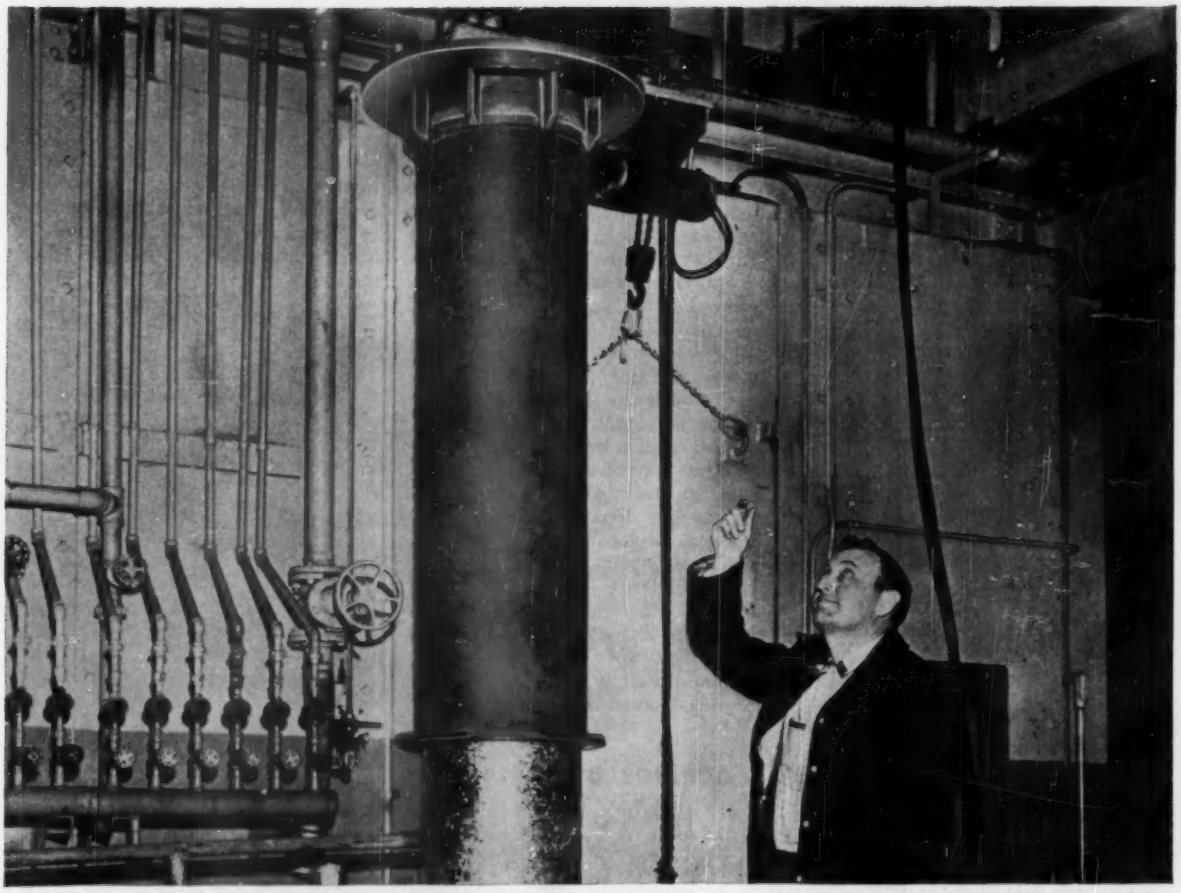
**MACHINE COMPANY, KENSINGTON, CONN., U.S.A.**

the field of engineering. The former should not be encouraged to make a change, because good mechanics are needed, and a good worker who is satisfied with his job is a happy worker and less likely to fall prey to the trouble-making element actively engaged in causing dissatisfaction among the employees.

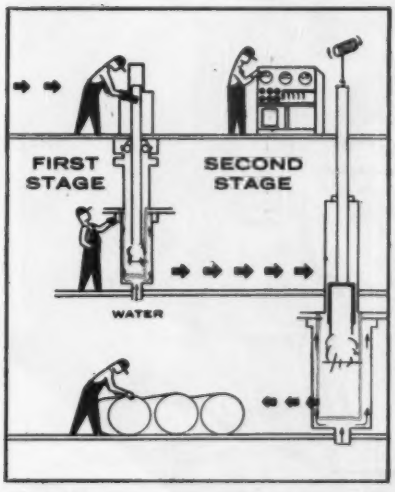
The first-class mechanic who is happy on the job should be left where he is if that is his wish. He (let's call him Harry for convenience) has a good job and likes his work. Harry knows the value of cooperation with his foreman and his fellow workers, and is intent upon doing all he can to promote the welfare of the firm for which he works. This contented chap goes home at the end of the day and enjoys the comfort of his pipe while he browses through the daily paper and, after an hour or more of TV he stretches his arms and contemplates a good night's rest. No doubt he'll spend a half-hour or more in front of his warming fireplace contemplating some scheme to improve the die he is working on at the shop or, perchance, cogitating on a unique idea to cut down the cost of production. The seed of progress is often planted in the mind of a contented worker as he idles his time before hitting the hay for the night. I have always contended that it is a downright shame to interfere with Harry's economic tranquillity by attempting to put him on a job where he will have to concentrate more, and where he drags himself to bed with a burdensome load on his mind. This kind of a chap doesn't give a tinker's dam about the crease in his trousers and is

*"Casey's the real old-fashioned type superintendent—runs the plant with an iron head."*



**STRIPPING** titanium ingot from crucible fabricated from Anaconda large-diameter seamless copper tube. During melting, the crucible is water cooled.

# How Copper helps make superior Titanium Ingots




**SPONGE TITANIUM** pressed into electrodes is melted in the first-stage arc furnace, forming ingots. Several such ingots are welded together and used as an electrode in the second melting. Double melting gives homogeneous, uniform ingots. A vacuum in the crucible assures low hydrogen content.

Titanium and titanium-alloy ingots that are homogeneous and have low carbon and hydrogen content are difficult to produce. Mallory-Sharon Titanium Corp. of Niles, Ohio, however, originated the double-melting process, "Method S," for production, which does the job.

A major factor in the successful production of ingots of sound structure is the use of water-cooled copper crucibles. Mallory-Sharon found that copper met the requirements for a satisfactory crucible material, particularly because of its high thermal conductivity.

Mallory-Sharon fabricates some of its crucibles more easily and quickly, using large-diameter Anaconda seamless copper tube for the body of the crucible. Various sizes are used for the crucibles—for example 20″ I.D. x ½″ wall thickness; and 15¼″ I.D. x ⅜″ wall thickness. These big Anaconda tubes are now playing a key role in producing the ever-growing tonnage of the new structural metal so vital in the production of America's jet planes.

The American Brass Company produces the widest range of seamless tubes available to industry. At one end are tubes in copper and copper alloys up to 26″ I.D. At the other are the capillary tubes as small as .032″ O.D. and wall thickness of .005″—for instrument control, activating lines, and other precision purposes.

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perfectly content with his apron or overalls.

Not so with his more aggressive contemporary. Morris, as we shall call this go-getter, served his apprenticeship and eventually became an expert workman. Unlike Harry, Morris is keenly interested in mathematics and keeps up with the progress of science. He feels that his horizon is rather limited although he enjoys his work in the shop. This fellow has the practical background for the making of a first-class engineer and will, no doubt, strive to compensate for his lack of a college degree by making every endeavor to catch up on his mathematical and scientific training.

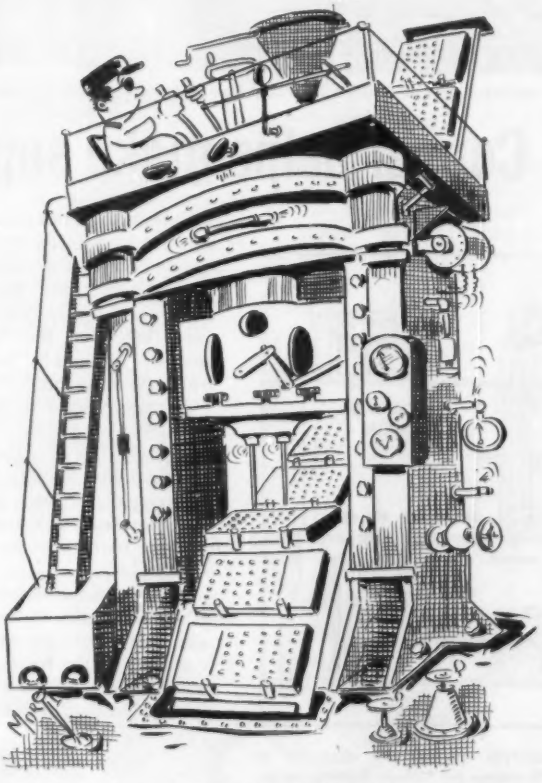
To my way of reasoning it is wise to select one to fill a vacancy in the engineering department who has a practical background and who possesses the willingness to gain essential knowledge in the particular field in which he is interested by sacrificing his own time to gain that knowledge.

Should a shop man desire to stay as such instead of advancing to the engineering end of the plant he would still have rewarding opportunities for advancement in the production phase. However, his field would be limited as compared with the chances for advancement and interesting diversity were he to enter the engineering phase. Of course, all come under the heading of engineering whether it be production engineering or design engineering.

Frank Van Horn
*Auburn, Calif*

So you'd sell your soul for a "white collar." OK, let's try one on for size. How's this one? You say you feel as though you're choking? Well, here's another; try this. It makes you feel wobbly? A little loose, you mean? But no matter, both are becoming and, from a distance, no one will ever notice. Either will do nicely, and until you can afford the tailor-made you'll look respectable —that's the main thing. Your wife can beam on you with pride, and no one will point a finger and tell

## Machines of tomorrow



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*—Onomatopoeia Company of Otoma—patentee*

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Last word in medium size jig borers—unequalled for extreme accuracy, capacity, increased output.

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| | |
|---|---|
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| Table Travel—Longitudinal | 20" |
| —Cross | 15" |
| Vertical Capacity | 23" |
| Throat | 20" |
| Weight | |

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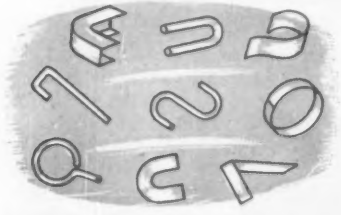

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your kids their pop is a lowly shopman.

Yes, you will be "upstairs" where everything is clean, shiny, and white. It might get monotonous, you admit, pushing a pencil all day. Your fingers might begin to drum on the drawing board as they itch for the touch of cool metal and you listen for the hum of power tools. But this is where the opportunities are. You'll see the big wheels come and go. You'll breathe the air of importance.

Then one day as you are passing the bulletin board you'll be startled by a notice that reads "Joe Smith—Assembly Supervisor." You'll remember that Joe used to work at the same bench with you in the shop; that you, in fact, taught Joe a lot of what he knows. And you'll recall that at the time you predicted "Joe has a lot on the ball; he'll go places."

But you also recall that you used to heckle Joe about "moving upstairs." You told him he was wasting his time and talent, and that he'd get ahead faster if he'd transfer to a white collar job. And then finally you said, "Well, so long, bud," because you got your transfer and you were going places.

Now as you stand there staring at the notice, you realize that being out of your element has licked you. That while you spent three years drumming aimlessly on a drawing board, and struggled vainly to keep up appearances on an annual salary, Joe has literally machined his way to the top. For three years he honed his wits and polished the edges of his dynamic personality. When the opportunity came he was ready. He trained hard and long, but his take-home pay was sometimes fat with overtime. Now he has won the real fruits of labor.

So there is the crux of the fallacious reasoning that deludes the shop worker into thinking it is plushy to sit behind a desk and quit at five as unrumpled as when he arrived in the morning.

The aim of labor movements is to equalize the standards of management and labor, and the shop man of today need have no fear that his talents and ambition will go unnoticed or unrewarded, for the truly talented man cannot hide his gifts, nor the truly ambitious be thwarted in his desire to learn.

Evelyn Mulligan
*Westbury, NY*

*"Ah, 'Tool Room' sound too formal."*

THE MAN who makes the jump from the shop to the drafting room is making a wise move. There are opportunities for advancement in the shop. However, the concentration is on production and not on instruction. There was a time in years past when the toolroom was the best school around. The toolmaker did creative work, functioning by cooperation between his hand and his mind. He designed and built the tools to do a certain job.

Today this is not the case. The toolmaker turns out tools or, perhaps, only parts for tools, from a blueprint, and may never see the finished unit. The work in the shop is being cut up into finer sub-divisions all the time and the men are being restricted to work on certain groups of machines. As a result, the toolmaker's imagination is confined and the thinking required is reduced to a minimum. The objective seems to be to make the toolmaker's hands extensions of the machine controls.

This is not to say that shop experience is not of value to the man who would make a career in the mechanical field. However, the young man of ambition, with the ability to learn, has a better likelihood for advancement and success in the drafting office. Here he can use his imagination, and demonstrate his creative ability. In the drafting office there are many more opportunities to face and solve problems, and it's by this process that true learning occurs. The new man in the drafting room usually has ample opportunity for consultation with the experienced men.

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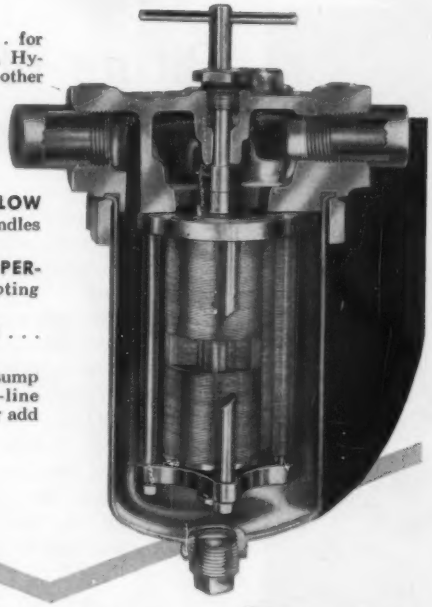

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ten and spoken word is the rule rather than the exception. The draftsman has constant practice and instruction in the art of expressing his ideas in pictures and words, both written and spoken. He has occasion to deal with people on many levels in the organization, and gets to know the company, its policies, and its executives. This training is valuable and increases the potential for advancement. On the other hand, the man in the shop is left very much to his own devices except for an occasional word of advice from a busy foreman. He seldom, if ever, has contact with anyone outside his own little circle, and opportunities for expressing himself are limited.

The shop and the work performed there are essential, but it just does not offer the opportunities of former years and the ambitious young man is wise to use it as a stepping stone, a place to gain experience, not as a permanent roost.

Henry George
*Yonkers, NY*

I BELIEVE it is part of our nature to think others are better off than ourselves, and some shopmen look with longing eyes on white-collar jobs. It seems to me if a shopman has too much respect for such jobs he is wasting his time, and possibly his employer's too, in the shop. His plan would be to have a go at what he fancies and see how he gets on.

I don't think Al should argue with Holland over his desire to be an office man. If he argued him out of his ambition Al would just be left with a lukewarm mechanic, a round peg in a square hole. That would be bad for the company and bad for Al.

The disinterested worker takes a

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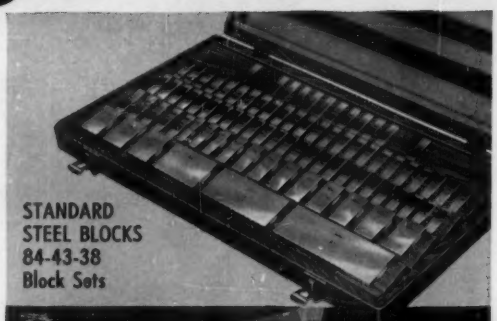

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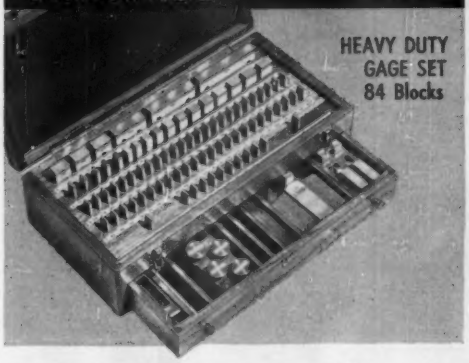

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lot of watching and a lot of individual teaching, too. I am all for having people working at the job they want to work at; it's half the battle. Holland may be fond of drawing, he may be good at it; that's the other half. A white-collar job, of itself, may mean nothing to him but a drawing board and a set of good instruments may mean much. No, I think Al's reasoning is all wrong in this case, and Personnel cannot fairly be expected to turn down the application of a potential designer just because Al does not want to lose a mechanic. Holland ought to be encouraged to make his own choice, and it is Personnel's responsibility to decide if he has a gift for the work he prefers to do and, if so, see him placed in it.

It makes little or no difference to a man's chances of success whether he works in shop or office. What does make a big difference is whether a man is working on a job his heart's in. It is the difference between the volunteer and the conscript. Enthusiasm and ambition are the principal ingredients of success in any job.

Ed takes a trick with his strong card about Holland given an opportunity to go to school at the company's expense if he takes the office job. If Holland has a burning desire to be a draftsman, I can think of no other consideration, not even a white collar, that would weigh more with him in deciding to leave the shop. If a young man with ambition and plenty of grit has a conviction that he must work in an office, and no where else, he will probably do just as well, financially, and in position in an office as in a shop. It will have nothing to do with promotion possibilities in the office as opposed to the shop.

J C Ball
*Stranraer, Scotland*

*"Why not take two savings bonds? They're small."*

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## New Books

MOTION ECONOMY AND WORK MEASUREMENT *[2nd Edition]—By Robert Lee Morrow. Published by The Ronald Press Co, 15 E 26th St, New York 10, NY. 468 pages, 6 by 9½ in. Price $7.50.*

First issued in 1946 as *Time Study and Motion Economy*, this standard textbook has been revised and expanded to include recent developments in the field of work measurement. Emphasis is on techniques and their application rather than theory, although enough theory is included to provide an understanding of the principles involved.

This edition includes several new subjects: the application of motion economy to office work, micromotion study and the equipment used, motion pictures of operations and analysis of the film, and organization for methods improvement. The chapters on time study have been brought up to date, and motion time standards have been added.

A large part of the book's effectiveness is due to its clarity and readability. The broad subject has been divided into 31 well-defined chapters, and the illustrative examples nicely complement the text.

Although basically a textbook, *Motion Economy and Work Measurement* should be a useful introduction to time study for executives and engineers either outside the field or only indirectly concerned with it.

•

INVENTORS AND INVENTIONS— *By C D Tuska. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 174 pages, 9¼ by 6¼ in. Price $3.75.*

This account of inventors and inventions, designed to familiarize the reader with the psychology and methods of invention, is basically a non-technical inquiry into the ways creative skill produces original discoveries. The author, Director of Patent Operations for RCA, is thoroughly familiar with his subject, and has produced a highly readable companion piece to his more technical work, *Patent Notes for Engineers.*

The introductory chapters consist of accounts of primitive man's inventions; the effects of environment,

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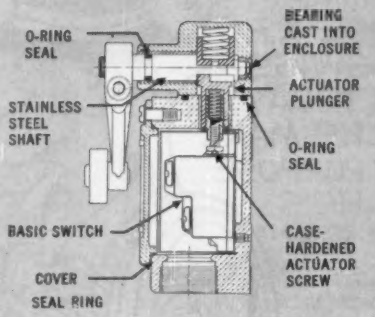


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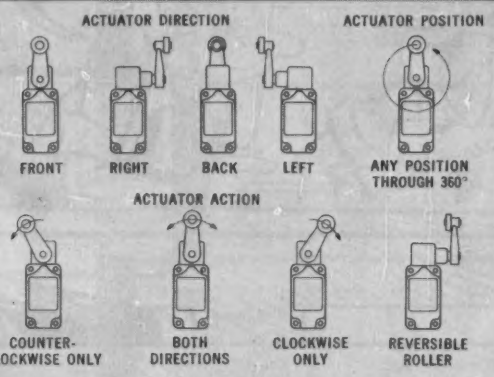


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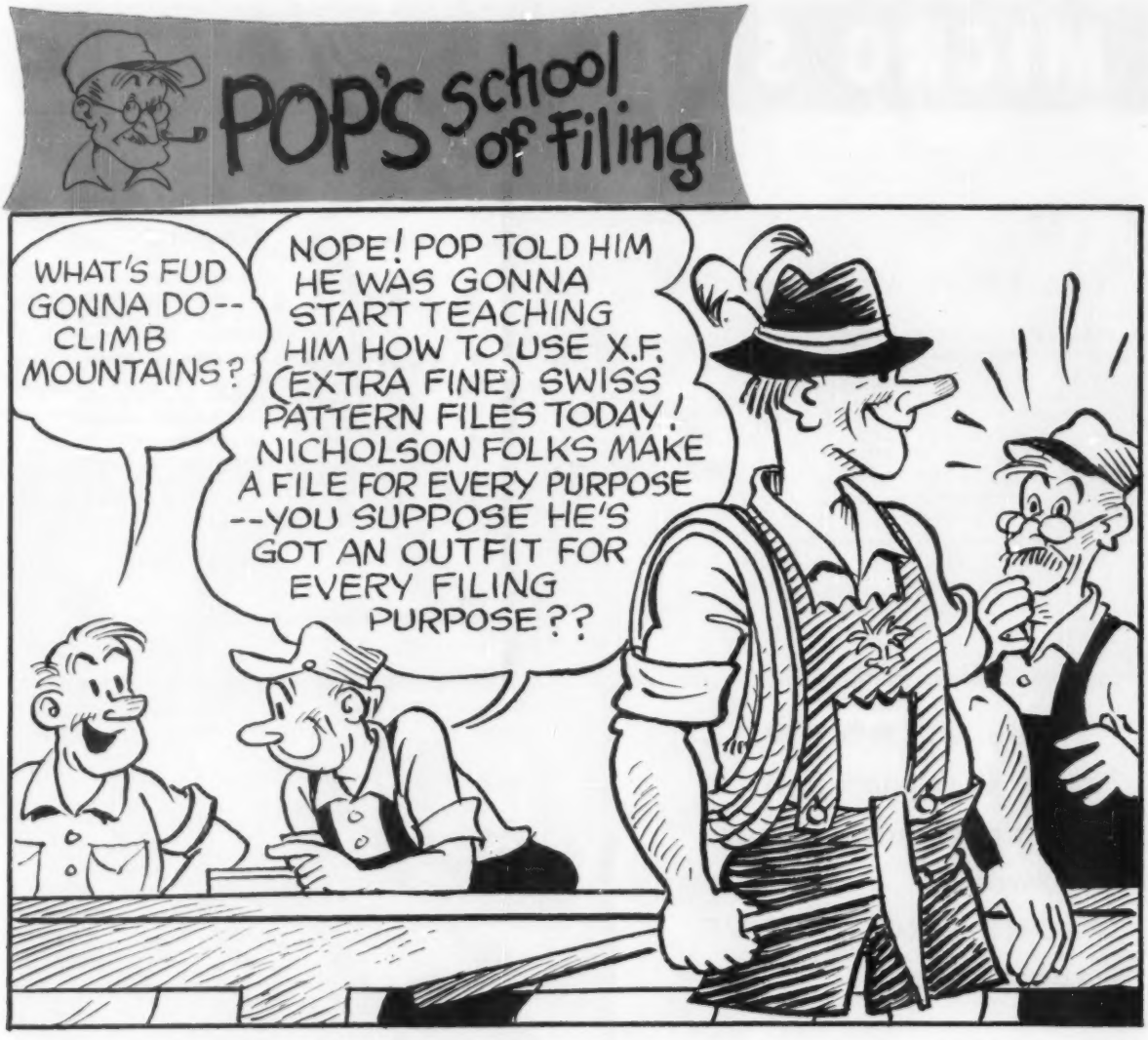
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age, and education upon inventors; and various methods or techniques of inventing. To supplement these generalities, specific case histories are recorded, such as how Edison invented the phonograph, what Mozart wrote about musical invention, and what Franklin discovered with his kite experiment. Every type of inventive method — experiment, accident, synthesis, imagination—is explored through the use of numerous case histories.

The closing chapters contain nonlegalistic suggestions on how to protect and patent inventions, and include practical pointers on ways to market original products.

•

PROCEEDINGS OF THE RETMA SYMPOSIUM ON RELIABLE APPLICATIONS OF ELECTRON TUBES—*Published by Engineering Publishers, GPO Box 1151, New York 1. 105 pages. Size 8x11 in.—paper bound. Price $5.00*

These papers are from the industry meeting, last May, at the University of Pennsylvania, and represent the latest thinking on testing, circuit design, specifying, and tube design as applied for long-lasting tube wear. This is specialized material for the electronics industry, although any engineer or interested observer could easily get a good idea of the problems involved in reliability by glancing through the booklet.

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PROCEEDINGS OF THE SECOND RETMA CONFERENCE ON RELIABLE ELECTRICAL CONNECTIONS—*Published by Engineering Publishers, GPO Box 1151, New York 1. 103 pages. 8x11 in. — paper bound. Price $5.00*

This meeting, held last September at the University of Pennsylvania, was co-sponsored by the Advisory Group on Electronic Parts, Department of Defense, and held with the cooperation of the University. The proceedings includes papers presented there and then on connection tools, techniques, materials, and measurements—in fact, the works. Authors of the papers are from industry, and are concerned with the latest methods; particularly dip or printed soldering and solderless connections.


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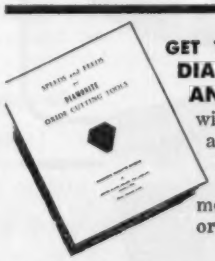

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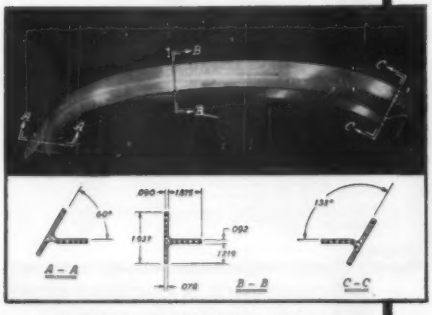
**The Contract Forming Division specializes in forming metal to curved shapes. Bath Radial Draw Form methods and stretch form methods are especially suited to producing accurate curved parts from extrusion, strip, sheet and pre-formed sections. A full range of equipment for auxiliary operations is available in the Forming Division.**

**Bath methods yield accurate parts in the toughest metals... jet engine rings, aircraft and missile shapes, and parts for many other industries.**



**The Contract Division's facilities are available for production of parts in lots of 100 to 100,000. Send your inquiries to our Estimating Department or write for literature describing in detail the Bath forming methods and the contract facilities available.**

THE CYRIL BATH COMPANY

32340 **AURORA ROAD • SOLON, OHIO**
(LOCATED IN THE GREATER CLEVELAND AREA)
Manufacturers of Radial Draw Formers • Dies • Tools
Press Brakes • Tangent Bending Sequence Presses • Press Type Brakes • Special Machines


# New Films

MODERN METHODS FOR JOINING METALS. *Produced by Linde Air Products Co, Div Union Carbide & Carbon Corp, 30 E 42nd St, NEW YORK 17, NY. 16 mm, sound, color. Running time 20 min.*

This new film shows a variety of welding processes and applications and is treated in a non-technical manner. Filmed in various fabricating plants and in the laboratory, it illustrates the importance of the welding engineer in industry. Also shown are the many factors involved in electric welding, and how research, development, and engineering serve to provide increasingly better methods and equipment.

•

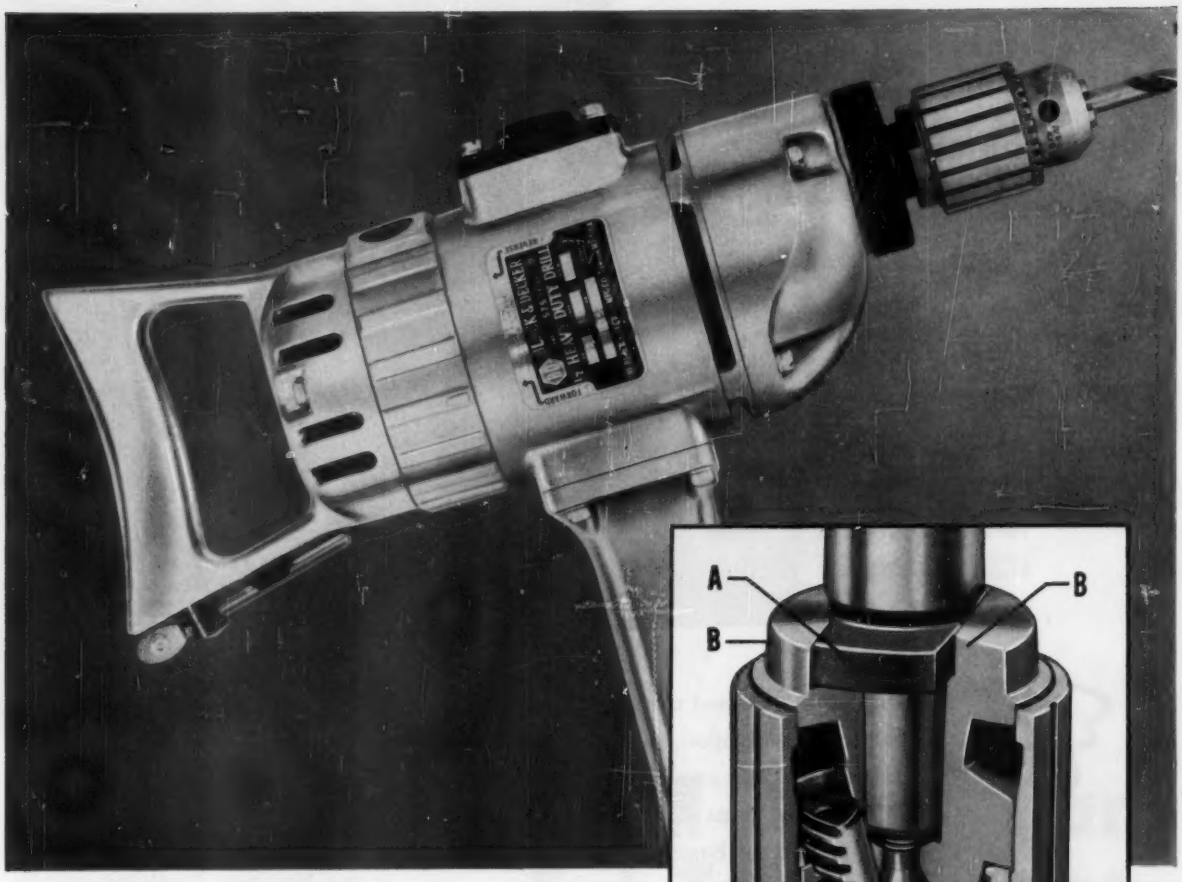
TWO HEADS ARE BETTER THAN ONE. *Produced by Engelberg Huller Co Inc, 831 West Fayette St, Syracuse 4, NY. 16 mm, color, sound. Running time 18 min. No charge.*

Based on a coast-to-coast survey of actual installations, this new film shows action sequences of the company's multiple-head, conveyor-type, abrasive-belt grinders in production on ferrous, non-ferrous, plastic, and other materials. Machines with from two to six grinding heads and conveyorized through-feed are shown performing multiple grinding operations in the same time as formerly required for a single operation, with no additional labor requirements.

•

THE ROCKFORD KOPY-KAT. *Produced by Rockford Machine Tool Co, Rockford, Ill. 16 mm, sound, color. Running time 36 min. No charge.*

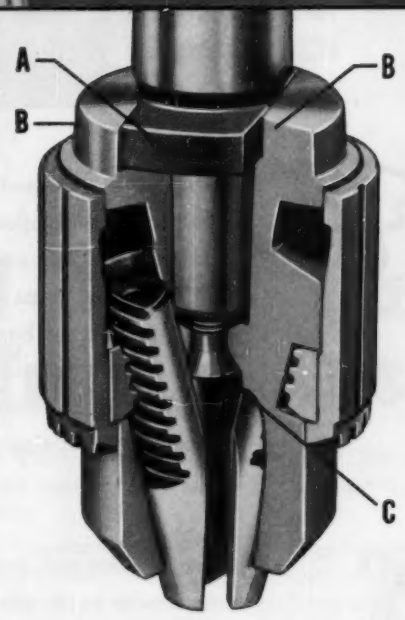
Design and operation of the Rockford Kopy-Kat hydraulic duplicator, an auxiliary tracing attachment for shapers, planers, slotters, and lathes, is explained in this new movie. It includes animated schematic diagrams illustrating the operation of the valve and hydraulic system, and shows a variety of actual duplicating jobs in operation.




# This new Jacobs chuck delivers the full power of the portable tool in both forward and reverse speeds.

*(Featured on Black and Decker's Big New Drills)*

The new Jacobs **Model KD** Chuck has a built-in "positive key drive" as an integral part of the chuck body. This "key drive" seats over the rugged driving flange of the drill spindle. The strength of this driver plus the friction of the Jacobs tapers guarantees that the full power of the drill motor is transmitted **through to the work.**




A—Positive driving spindle flange
B—Built-in "positive key drive"
C—Retaining screw

### An added safety feature

In addition to the positive drive, **Model KD** is locked to the spindle with a retaining screw which prevents separation of chuck and spindle under any conditions.

### Ease of chuck removal

The chuck also may easily be removed from its spindle to permit the mounting of other accessories. It may also be easily remounted without loss of accuracy.

### Recommended for heavy duty drills

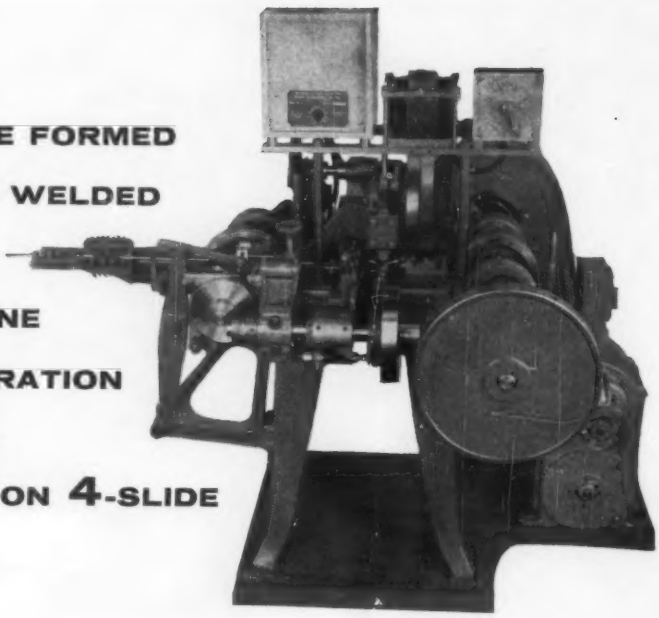
The Jacobs **Model KD** was designed for heavy duty portable drills—electric and pneumatic—especially for reversible types.

**JACOBS AND YOUR INDUSTRIAL SUPPLY DISTRIBUTOR**
are ready to deliver the chucks you need and the service you deserve.
***first in chucks . . . first in service***

**Jacobs**
**CHUCKS**

**The Jacobs Manufacturing Company**
West Hartford, Connecticut

**WIRE FORMED AND WELDED IN ONE OPERATION WITH NILSON 4-SLIDE**



Garter loop formed and welded in one fast operation by Nilson 4-Slide.

Production is increased more than 25% by Hawie Manufacturing Company using a #1 Nilson 4-Slide with welding attachment which eliminates need for ferrule loops in the manufacture of hose supporters. .062 soft basic wire is formed with ends welded in one automatic operation at a conservative 105 pieces per minute. Additional savings are realized in eliminating cost of ferrule.

*Another example* — Drapery hook is formed with two wires entering 4-Slide simultaneously and automatically welded together at point of contact.

Nilson 4-Slides will produce many types of wire forms similar to the part shown here in which two pieces must be welded or otherwise closed together. By the mounting of automatic welding equipment on the 4-Slide, such parts can be produced in one fast, accurate operation at minimum cost. Nilson 4-Slide Wire Forming Machines are available in a wide range of sizes to handle basic steel wire from 1/32" to 1/2" diameter.

A.H. NILSON MACHINE COMPANY

1519 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines


# Names in the News . . .

**William D Ross,** vice president, manufacturing, of J J Tourek Manufacturing Co, Chicago maker of ball joints and screw machine products, has been elected president of the corporation. **R A Burritt,** formerly assistant general factory manager of the Chicago Screw Co, has been named vice president and factory manager at Tourek.

**Allan B Fredhold**, staff engineering manager of Aeroquip Corp, Western Division, Burbank, Calif, has been appointed plant manager of General Logistics, Pasadena, Calif, subsidiary.

**Harland L Printz**, superintendent of fabrication for Westinghouse's Aviation Gas Turbine Division, Kansas City, Mo, has been appointed superintendent of tooling there.

**Dale A Lichty,** senior vice president of Hydro-Aire, Inc, Burbank, Calif, has been elected president of the company. He succeeds **Homer H Rhoads,** who has resigned.

**Raymond Boyd, Jr,** manager of the air appliance department of US Hoffman Machinery Corp's Industrial Divisions, has been appointed manager of the divisions, and of foreign operations.

**Whitmell T Rison**, manager of the replacement division of Thompson Products, Inc, has been named a vice president of the company.

**Albert M Dexter,** manager of gage research at Pratt & Whitney Co, has been named assistant to the manager of the Gage Division of the company.

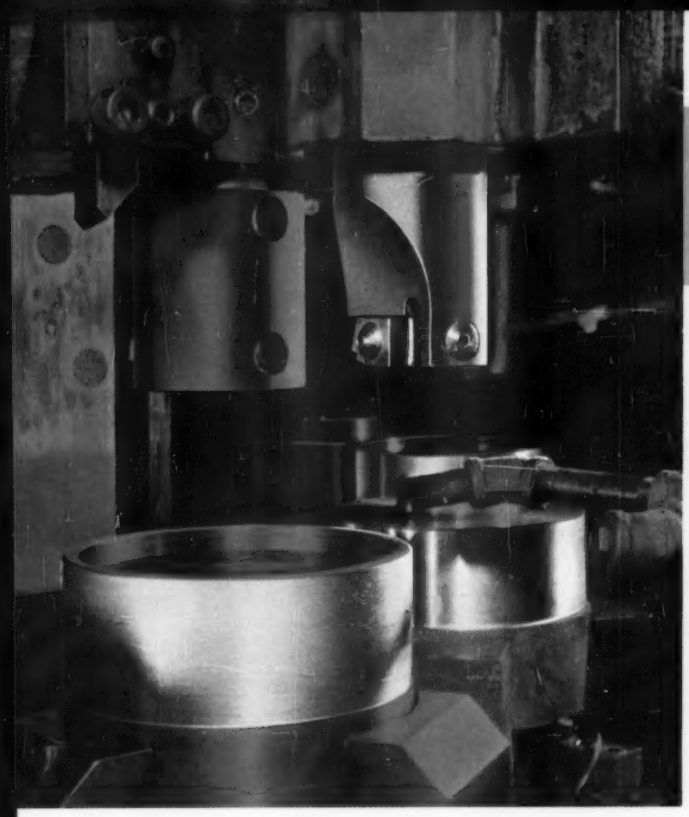
**Hans Ernst,** director of research for Cincinnati Milling Machine Co, has been awarded the ASTE Research Medal by the American Society of Tool Engineers.

**Lewis S List** has been named manager of the air appliance department of US Hoffman Machinery Corp's Industrial Divisions.

## OBITUARIES

**Ernest Mortensen,** recently retired president and general manager of Wesson Tool Co, Ferndale, Mich, died March 22.

**John R Fulton,** vice president of Wheelock, Lovejoy & Co, Cambridge, Mass, died March 19.



# TOOL NEWS carbide

***Throw-away inserts in micro-adjustable tools drop costs from $4.50 per 1000 pieces to 43¢***

# WESSON Boring Bars Cut Turning Costs

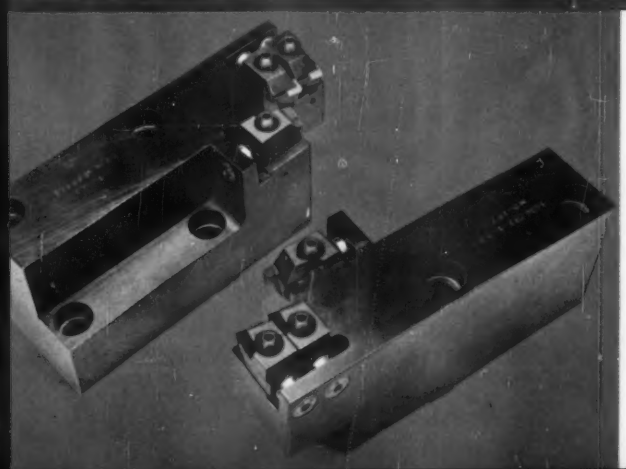
Replacing conventional single point tools, Wesson-metal throw-away inserts in micro-adjustable **WESSON** boring bars are showing the following savings on a planet carrier housing turning operation:

**Tool grinding eliminated**
**Tool cost cut from $4.50 to 43¢ per 1000 pieces**
**Tool-change down-time cut 93%**
**Tool re-setting after sharpening eliminated**
**Pieces per tool change almost doubled**

Since the only change in the tooling, when dull, is to index the insert or replace it after 8 indexes, no tool-change-adjustment is required after the first setup. The latter is quick and positive because of the micro-adjustment feature (0.001 inches per graduation on the screw head).

Again, therefore, **WESSON** insert tooling demonstrates the ability to slash the really important tool costs—those hidden costs in tool grinding, down time, etc.—which usually far outweigh initial tool cost. The reduction in initial cost in this case was only 4 cents per 1000 pieces. The "upkeep" cost, however, was slashed $4.00 per 1000 pieces . . . without even figuring in the eliminated down time.

For data on these tools ask for Bulletin #MB-157.

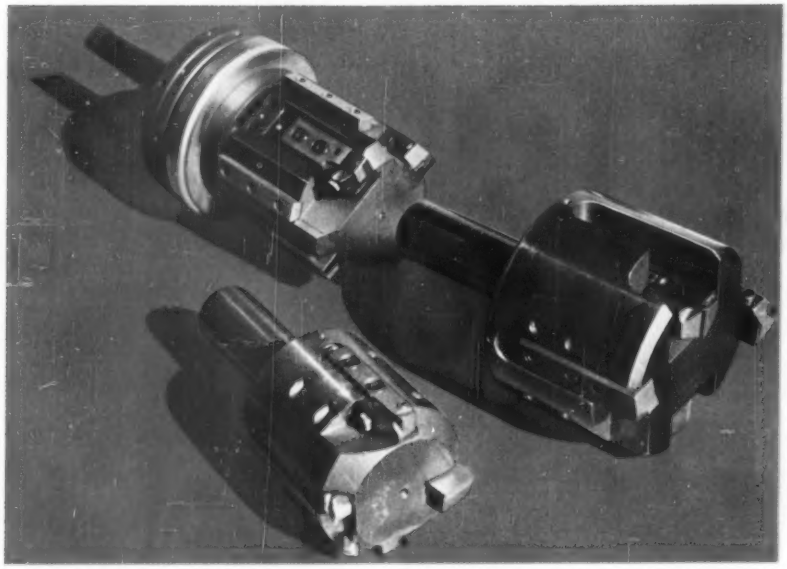


## Tool Blocks for Throw-Aways are Micro-Adjustable

The **WESSON** tool blocks shown here are used to rough and finish turn and face transmission parts on an Ex-Cell-O two-spindle machine. Micro-adjustment permits rapid setup, each division on the calibrated screwhead being equal to 0.001 inch. The square inserts provide eight cutting edges, high production per insert, and low tool cost.

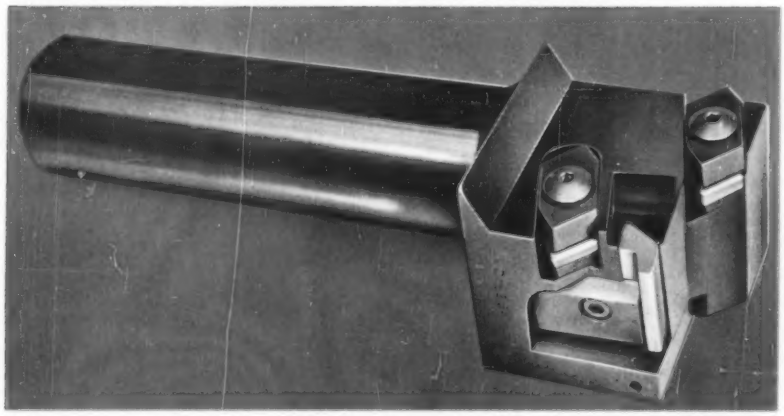
carbide **TOOL NEWS**

# Throw-Aways for More New Uses



These three special tools perform a combined total of some 10 operations. The 4-tooth cutter in the rear is for counterboring. Its 4 teeth are micro-adjustable for diameter, the screw head being graduated in 0.001 inches of movement. Quill in the foreground is used for facing, forming a step, counterboring, grooving and chamfering. Tool at the right is used for combination of internal and external operations: turning two OD's, facing and counterboring. All have these features in common: They are designed to use Wessonmetal throw-away inserts; they are rapidly set up; they cut down-time for tool changing to a minimum; they eliminate all tool grinding; and they greatly reduce tool costs per piece produced.

# Both Throw-Away and Slug-Type Inserts Used in Tool Holders



Throw-aways may be combined with slug-type inserts to effect optimum machining efficiency and economy. For instance, use of both slug type (on-end) inserts and throw-away types in the same tool holder is recommended where grooving is to be combined with such operations as turning or chamfering. Reasons: wear is greater on grooving than chamfering tools. Slug type insert can be quickly re-ground. Special throw-away insert for this use could not be indexed and would be too costly. Shown here is a typical tool holder with both types of inserts.


tools Wesson carbide Wessonmetal

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1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
**WESSON CUTTING TOOLS, LTD.**
93 JUDGE ROAD, TORONTO 18, ONTARIO


## Ideas in Throw-Away Insert Micro-Adjustable Tools

***Get our Bulletin #MB-157***

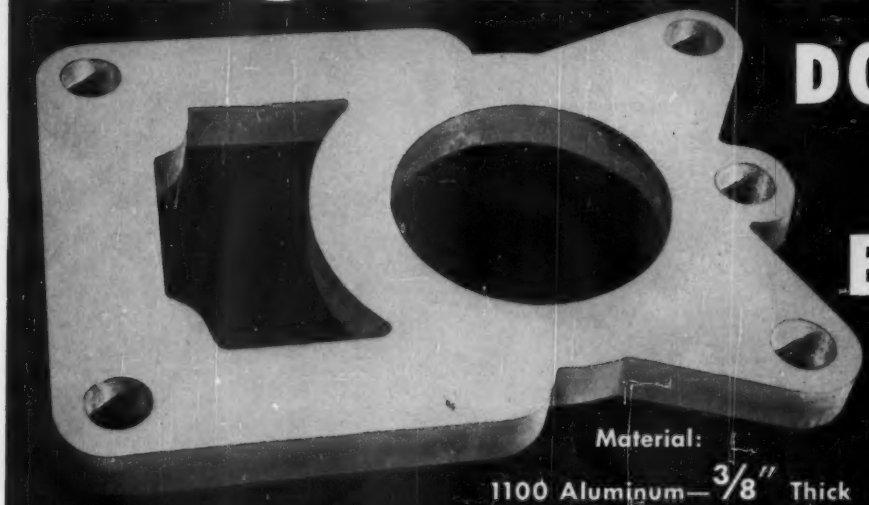
You'll find it valuable in planning for the retooling of turret lathe operations on which you want to cut tool costs per piece and down-time for tool changes. Also gives specifications and prices, shows standard replacement parts, 15 line drawings.

***Bulletin #PG-157***

Get this bulletin. It will tell you how to cut your grinding costs on carbide tools, how to get greater diamond wheel life; how to boost grinder output per hour from 30% to 50%; how unskilled operators can get better tool finishes than skilled operators on other grinders; how to cut tool regrind cost almost in half.

LITHO IN U.S.A

# WILL STAMPINGS DO YOUR JOB BETTER ?




**CASE HISTORY:**

## Redesign from casting to stamping cuts piece price 66%... tooling cost 53%

★ **BREAKAGE ELIMINATED**

Wrought aluminum alloy gives greater strength characteristics, eliminating breakage which occurred with the original cast part.

★ **MACHINING ELIMINATED**

Blanked and pierced part is complete as pictured. No additional machining of holes or top and bottom surfaces is required. End result is a better part at lower cost.

★ **COST REDUCED**

Piece price reduced 66%. Original cost of the casting plus necessary machining was $1.45 each in lots of 1000. *Cost of stamping is 50¢ each.*

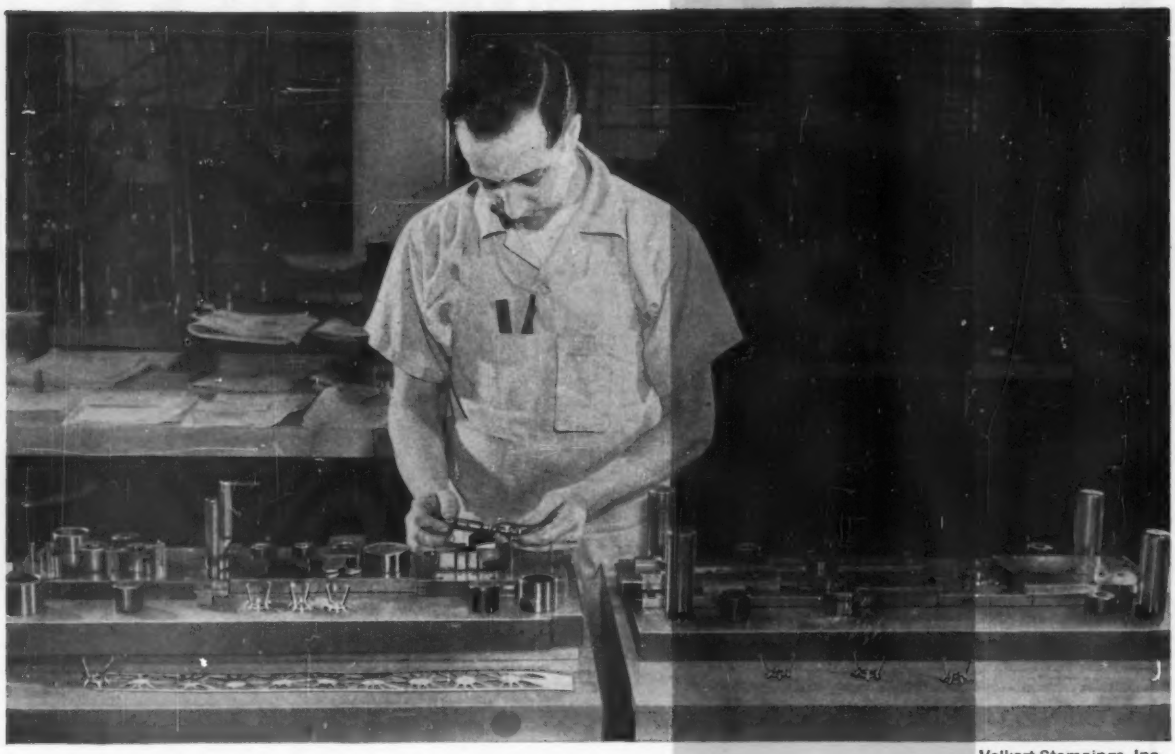
Tooling cost reduced 53%. Original cost of pattern and drill jig was $301.00. *Tooling for stamping cost $140.00.*

**WILL STAMPINGS DO *YOUR* JOB BETTER?**

**Analyze your production parts and check with...**

**DAYTON ROGERS**
*Manufacturing Company*
**MINNEAPOLIS 7H, MINNESOTA**

# Why the Die Maker Prefers PRODUCTO Die Sets



Volkert Stampings, Inc.

## *The die maker likes to work with Producto Die Sets*

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

**DIE SET DIGEST,** our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

**THE PRODUCTO MACHINE COMPANY**
975 Housatonic Ave., Bridgeport 1, Connecticut

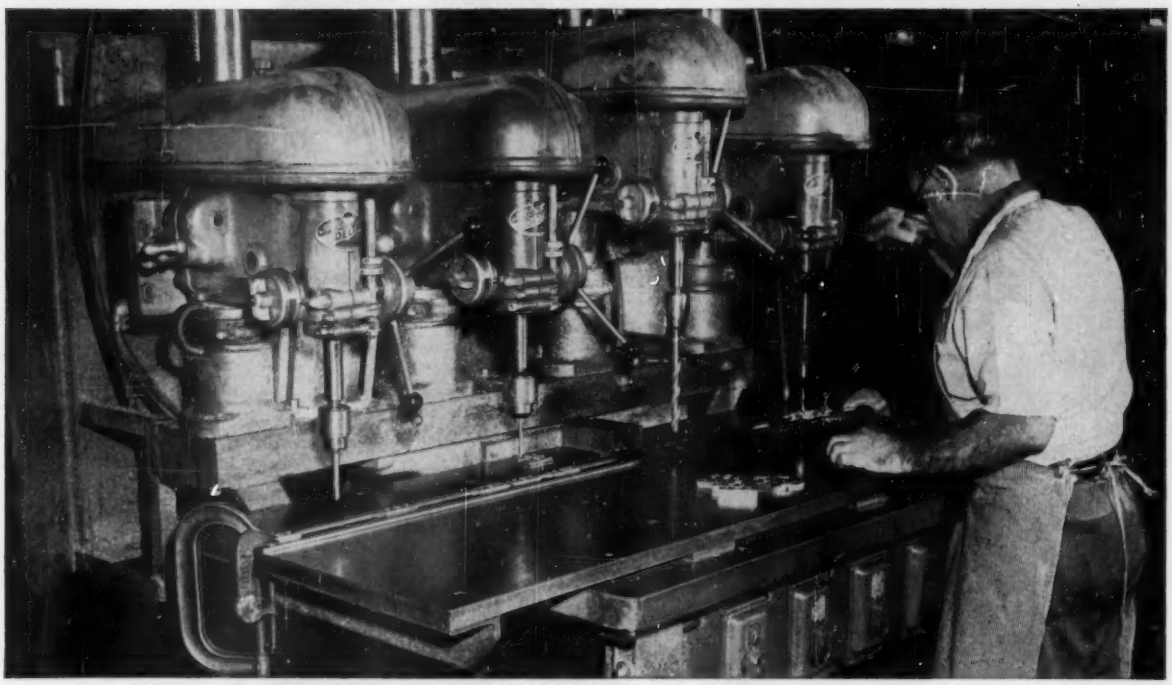
Wherever die sets are used

**PRODUCTO**

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

ROCKWELL-BUILT

# DELTA drill presses



## . . . save cost of expensive machines

*for General Bronze Corp., Garden City, N. Y.*

FLEXIBILITY NEEDED—"Producing custom ornamental metal work for architectural use calls for limited production runs and fast product output," says Joe Gafney, Plant Engineer, "and Delta drill presses give us maximum flexibility to meet these constantly changing production demands."

PRECISION AT LESS COST—This Delta drill press set up drills, countersinks and counterbores over 500 bronze window blocks per day, with precision that eliminates costly rejects. And stock Delta power tools provide an inexpensive way to meet peak work loads and prevent bottlenecks.

LONG LIFE, LOW MAINTENANCE—"We have some Delta equipment that has been in regular use for over 15 years," says Mr. Gafney, "and still performs with almost no maintenance. Rugged construction and low-cost maintenance are Delta Quality features we really appreciate."

SEE THE ENTIRE DELTA LINE—Get all the facts on the world's most complete line of drill presses and accessories. Compare for quality, for value—and make up your own mind. Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your telephone book.

*Send Coupon for All the Facts!*

DELTA ROCKWELL

another product by **ROCKWELL**

**Delta Power Tool Div., Rockwell Manufacturing Co.**
**618E N. Lexington Ave., Pittsburgh 8, Pa.**

- ☐ Please send catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

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ANNOUNCING THE NEW

# Measurement Automation Division

(AVREL MASON, General Manager)

for the design, manufacture and sale of

**CARGILL-DETROIT**

measurement automation machines and controls

MACHINES FOR

- Automatic Production gaging
- Automatic Production classifying
- Automatic Production selective assembly matching
- Automatic Production functional testing

AND

- Continuous proportional feed back grinder size control
- Machine tool servo control systems
- Standard electronic building blocks for high speed production measurement
- Remote indicating production control systems.

The engineering, manufacturing, and supplying of our gages and controls for automatic manufacturing have grown to the point where a separate Division is the sure way to serve our customers best. *Mr. Avrel Mason*, as General Manager of the new Division, will now give full time to the automation controls and measurement machinery developed under him by Cargill-Detroit.

These products have been in use by customers for nearly 3 years. Best known members of the "family" are:

***Continuous proportional feedback size control, which is adaptable to any standard grinder.***

***Standard components for automatic size control and gaging systems.***

Built by machinery builders, for production applications, Cargill measurement automation improves the output quality, and speed, of your standard machines.

Tell us your needs and we will submit an engineering appraisal.

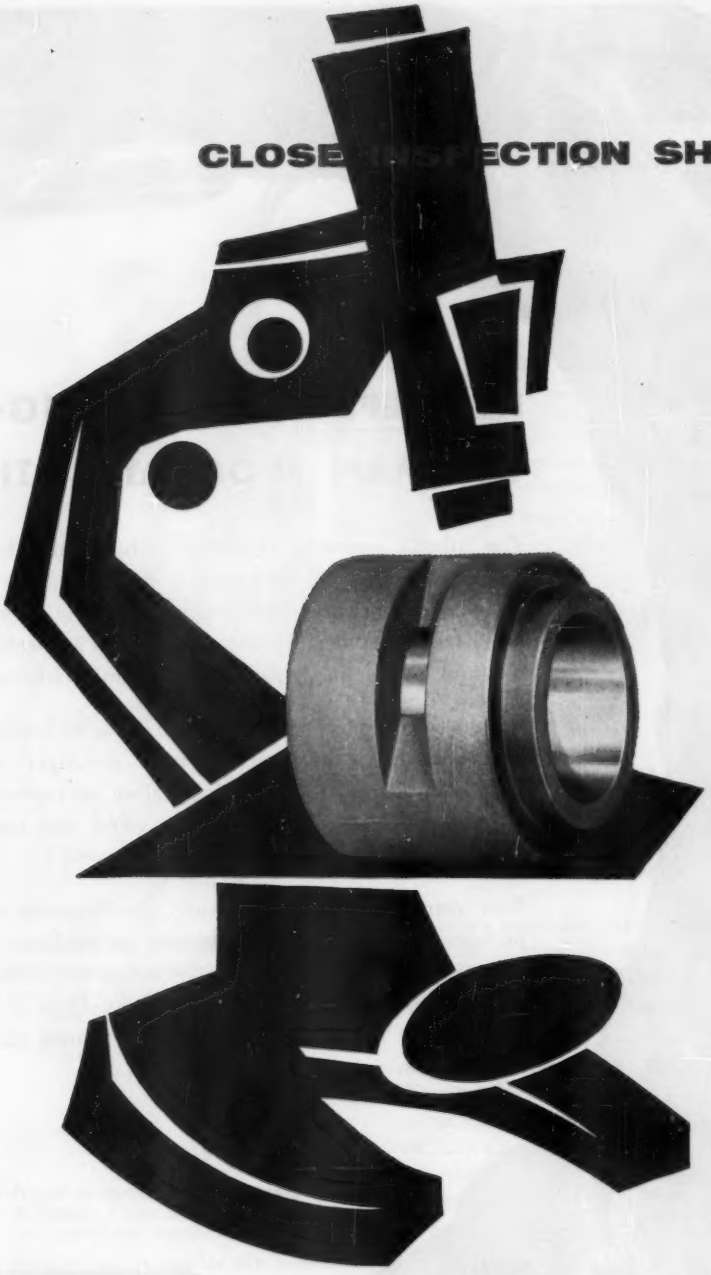
**CARGILL · DETROIT** *Corporation*

2254 Cole Avenue Birmingham, Michigan

*Designers and Builders of Automatic Manufacturing*

Established in 1949

CLOSE INSPECTION SHOWS . . .



# only four-dimensional honed holes

## MEET TODAY'S PRECISION TOLERANCES

All precision hole work you produce *must* meet close tolerance specs on the FOUR DIMENSIONS if the part is to give good service on today's precision equipment.

The Sunnen Honing Machine will produce bores that "measure up" on ALL FOUR DIMENSIONS:

ROUNDNESS—It guarantees geometrically round holes—corrects any pattern caused by chucking, heat-treat or previous operations . . . with minimum stock removal.

STRAIGHTNESS—It levels all internal irregularities for end-to-end precision—corrects taper, waviness, bow, hourglass and barrel shapes.

DIAMETER—Precision sizing is quick and economical . . . with production tolerances down to .0001" . . . to as close as .000025" if needed.

SURFACE FINISH—It produces any finish required—as fine as 2 micro-inches RMS in hardened steel . . . no heat checks or smear metal.

**GET ALL THE FACTS ON SUNNEN HONING**
**send for five informative booklets**

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The Atlantic specialist in industrial lubrication is a highly skilled expert. He's spent years in the study of every heavy lubricating and cutting-oil problem . . . and he's backed by other Atlantic specialists in lubrication research, production, quality control and marketing.

Atlantic's experience since 1870 has made us familiar with *your* lubricating needs. We've developed the products necessary to do any lubrication job perfectly . . . at the lowest cost . . . for every wheel that turns in industry.

Your company can benefit from our extensive experience and services. For further information on Atlantic's family of products for industrial lubrication and metal processing, write or wire Dept. R-5. The Atlantic Refining Company, at the nearest office listed below.

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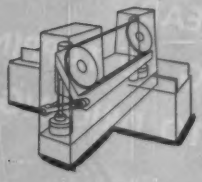
# Heavy Cut-off Work Now Done with Band Sawing Economy

**DoALL**
**POWER SAW**
**24" x 24" Capacity**
**HEAVY DUTY Horizontal CUT-OFF SAW**



**HORIZONTAL SAWING HEAD**
Unique design insures ample power and rigidity for new rugged beam 2" wide Demon H55 Saw Band. You get heavy cuts at high speed, long band life at low tool cost.

## *New Design packs power, rigidity and speed for the big cut-off jobs.*

Here's a machine that was designed *from the ground up* to meet a growing need by steel mills and warehouses, shipyards and other fabricators for high speed, dead accurate cut-off of heavy work pieces.

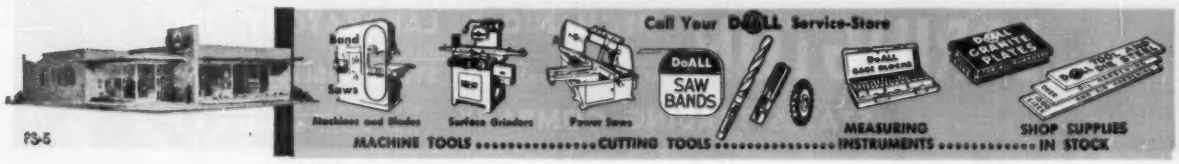
The new DoALL Power Saw Model 24 packs power, rigidity and speed behind a new rugged, continuous cutting 2" wide Demon HSS band. It will cut heavy bars, pipe, billets and structural shapes in a fraction of the time *at a fraction of the cost* of any cut-off machine of comparable capacity. And the narrow-kerf cut will give you a bonus of many more cuts per piece in material savings alone!

Its revolutionary horizontal design results in a combination of structural simplicity, speed and accuracy of cut with new ease of handling heavy work. Variable speed, fluid drive, complete automatic operation, automatic indexing of blanks up to 12' long, and power positioned hydraulic vises are just a few of the revolutionary time and money saving features of this new Power Saw. Call your local DoALL Sales-Service Store for details on this outstanding investment today or write: The DoALL Company, Des Plaines, Ill.

**FEATURES**

- *Finger tip control* for instant response to change in speed or direction. (Manual control also available.)
- *Powered rollers* position the heaviest work pieces
- *Fluid drive speed control* meets broad range of cutting requirements.
- *Automatic indexing table*
- *Power positioned hydraulic vises*
- *Automatic self-drain chip removal*
- *Positive feed coolant system*

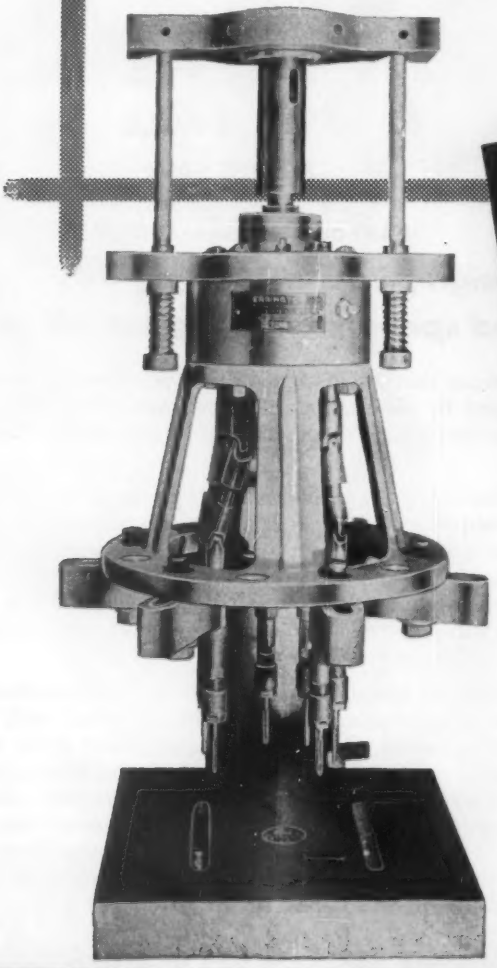
*For Lowest Cost . . . do it on the DoALL!*



# ERRINGTON

## UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD

**Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.**



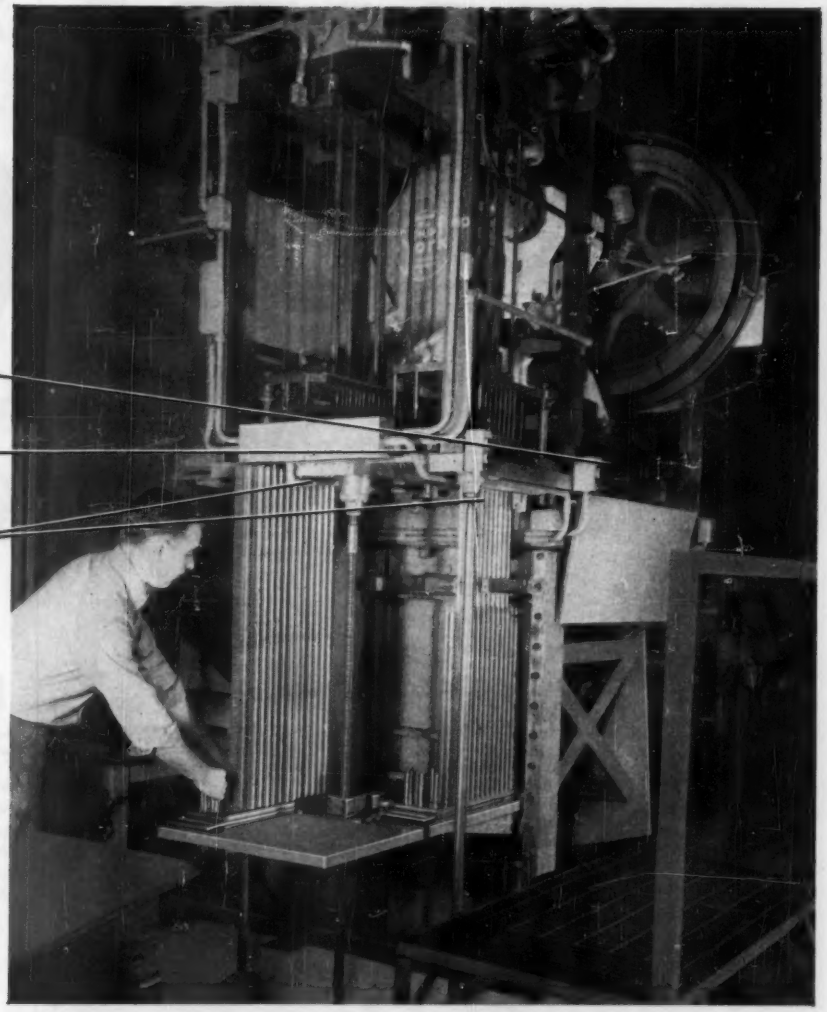
**LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING**

**#0—0" to ¼" Tap Capacity**
**Min. centers 11/16"**
**Max. Pattern 5¼"**

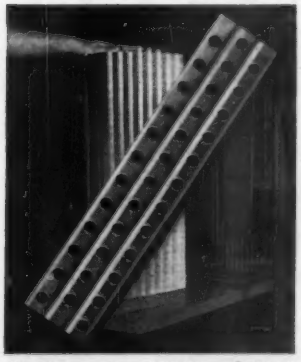
**#1—7/32" to ⅛" Tap Capacity**
**Min. centers 1½"**
**Max. Pattern 8"**

***Send For Complete Information***

**ERRINGTON MECHANICAL LABORATORY, INC.**
*Established 1891*
*Main Office and Plant:* **STATEN ISLAND 4, N. Y.**
*Export Office:* **STATES TRADING COMPANY** 401 Broadway, New York 13
Cable Address: STRADESCO, N. Y.




# Tooled presses save assembly time at York



Aluminum fins (.006" or .008" gauge) are fabricated and stacked at rates up to 180 per minute.

York Division of Borg-Warner, wanted to combine a fabricating and assembly operation in the production of fin coils for air conditioning and refrigeration systems. *Objective: eliminate a time-consuming manual stacking operation that, in a period of expanding production, would grow increasingly expensive.*

V & O supplied equipped presses for the job. Fins, complete with skip-corrugation, holes and spacers, are made in a two-station die; then collected in a stacking mechanism and pushed down onto tubes.

Presses that integrate or combine operations are the primary business of V&O. Our long-slide presses are designed for automation. Our engineering is geared for it. We would welcome a chance to go over the possibilities of using mechanized presses to integrate or combine operations in your plant. Please write or call us.

**THE V & O PRESS COMPANY**

DIVISION OF EMHART MFG. CO.

**301 UNION TURNPIKE, HUDSON, NEW YORK**

*Presses and methods that automatically reduce costs*

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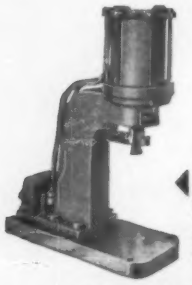
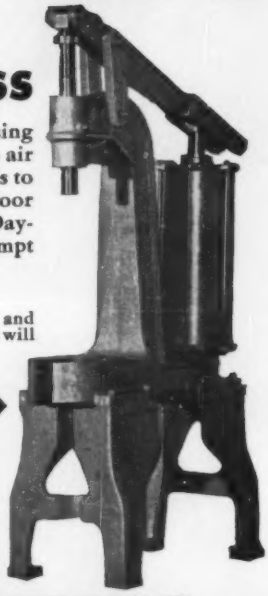
It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.



**WRITE.** Complete information and prices on Hannifin Air Presses will be sent on request.



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Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

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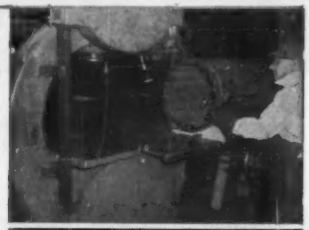

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If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

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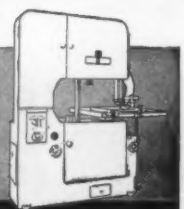

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ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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# HAMIKLEER Coolant

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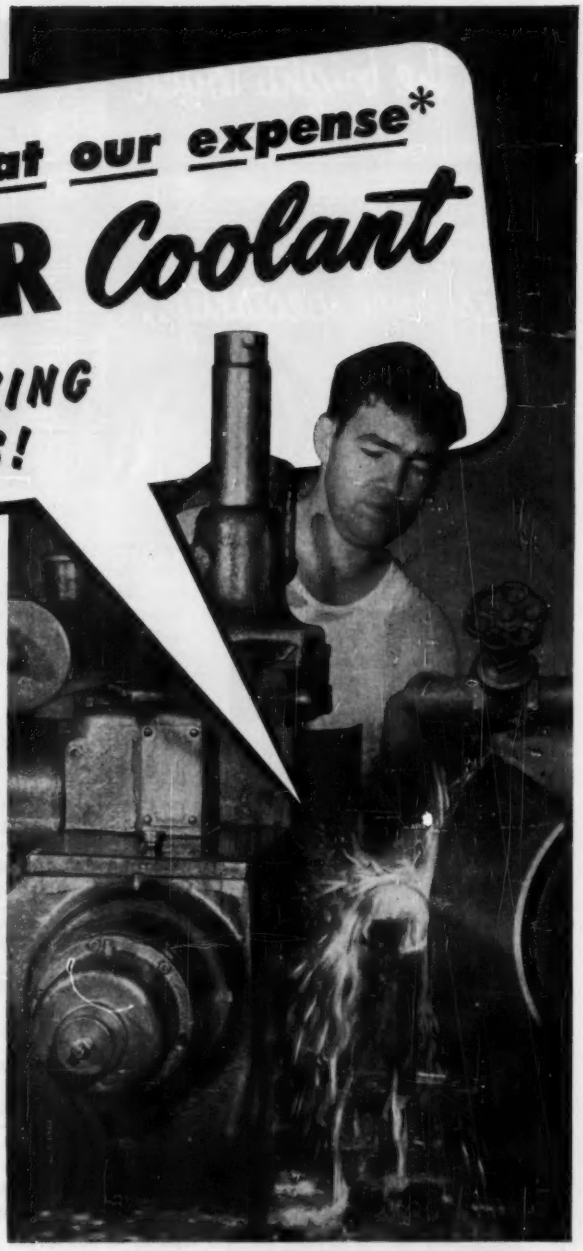

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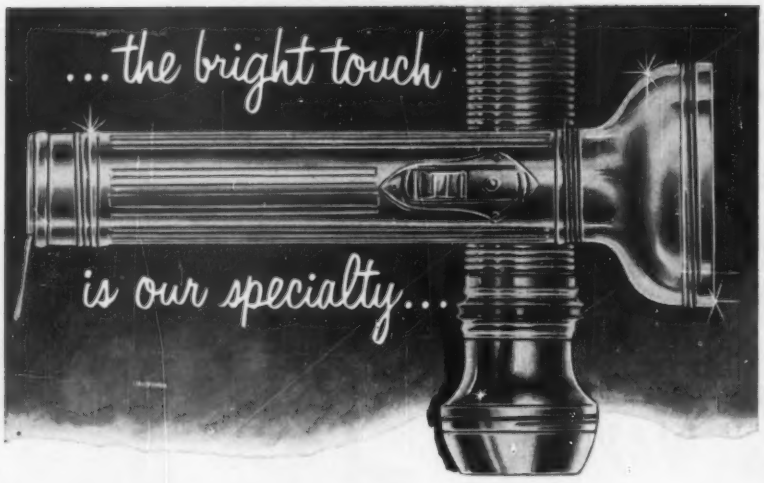

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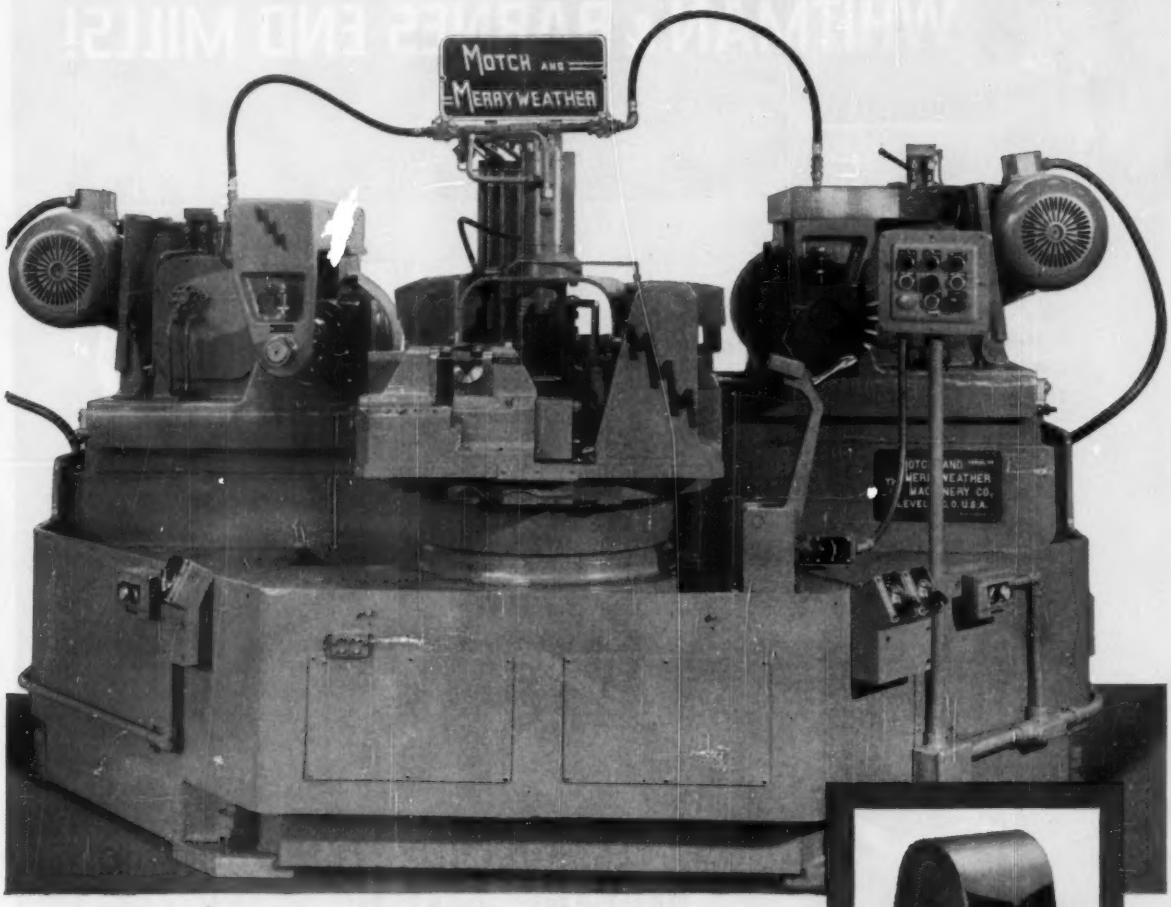
## Another specialized machine by M & M

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*for milling and slotting chain links*

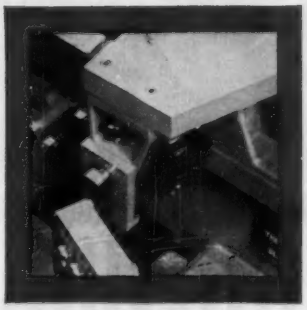
**Operation**—Straddle and form mill on right hand station, slot or straddle mill on left hand station.

**Universal**—Six different sized parts run over this machine.

**Cycle**—Either automatic or manual cycle. Cycle time, 64 seconds.

**Feed**—Custom-designed and built hydraulic head feed, index and clamp.

**Fixtures**—Four fixtures are mounted on index table.



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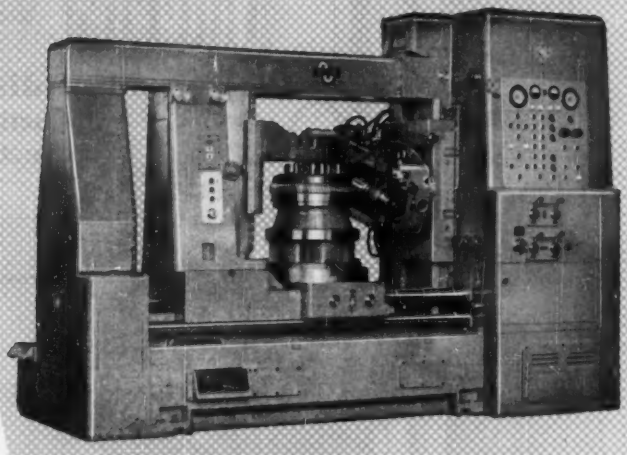

## FN 9

for gear diameters up to 900 mm with work-arbor support and pitches in steel up to module 9

**FP 7 production machine**
for gear diameters up to 600 mm with work-arbor support and pitches in steel up to module 7

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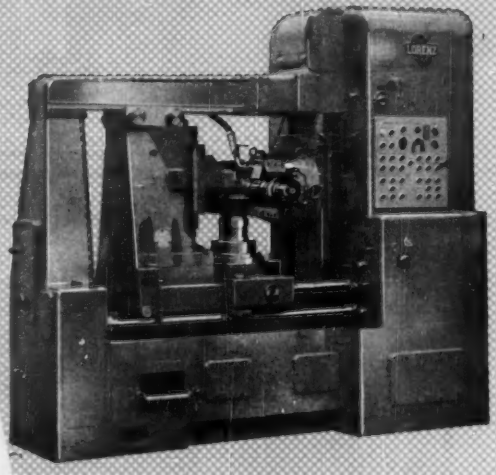

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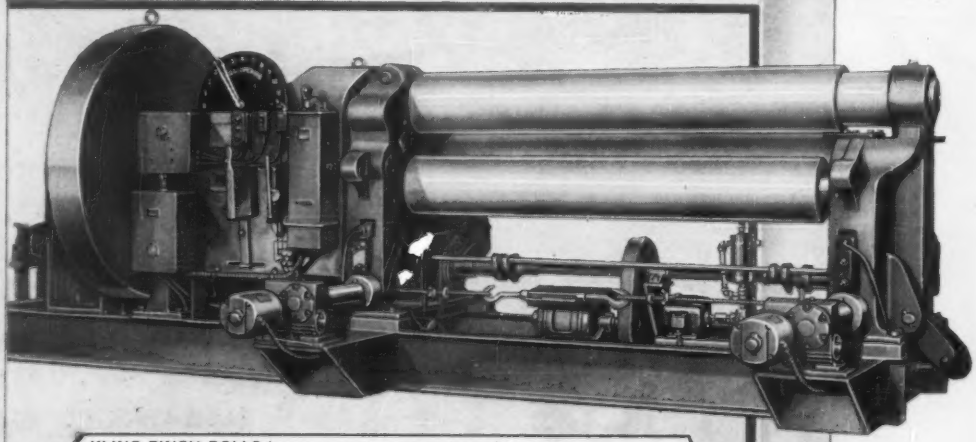

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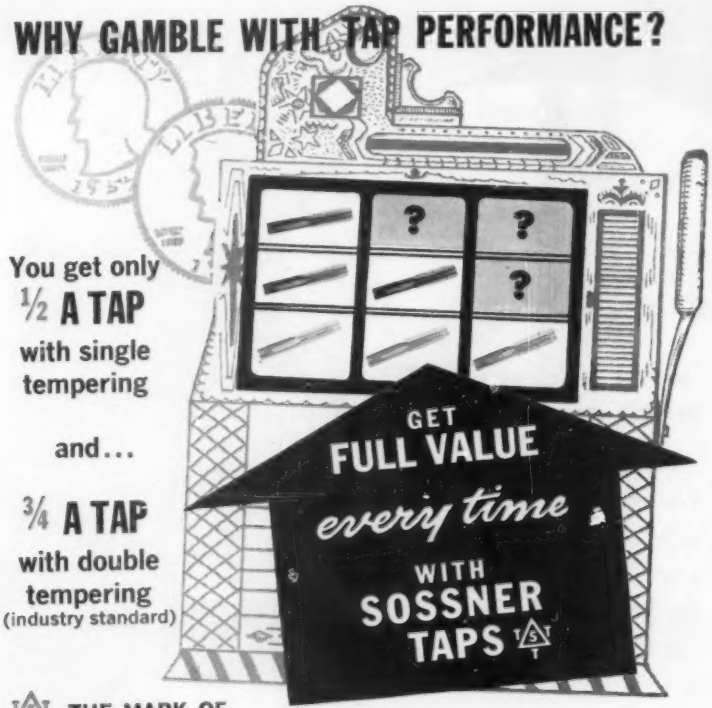


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## What's Ahead? . . . see Page 2

Yes, American Machinist's "Chips" column on page 2 of each issue forecasts coming events in future issues, and also points up behind-the-scenes stories of how current articles are gathered and written. Form the "Chips" habit—read it every issue.

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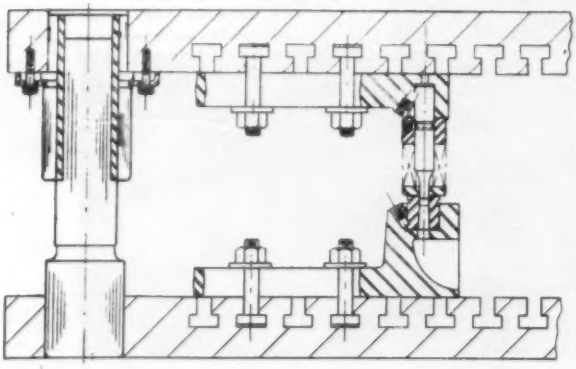
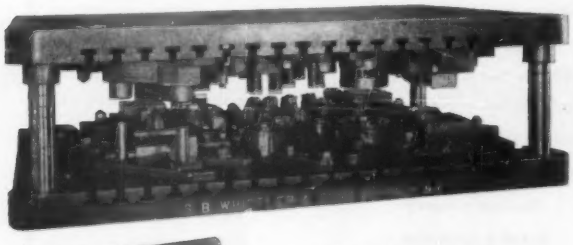
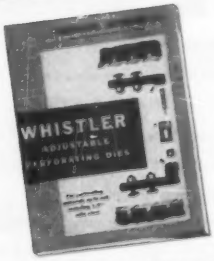


**Above:** Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.



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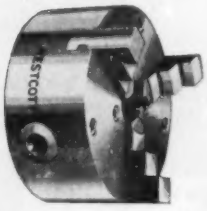

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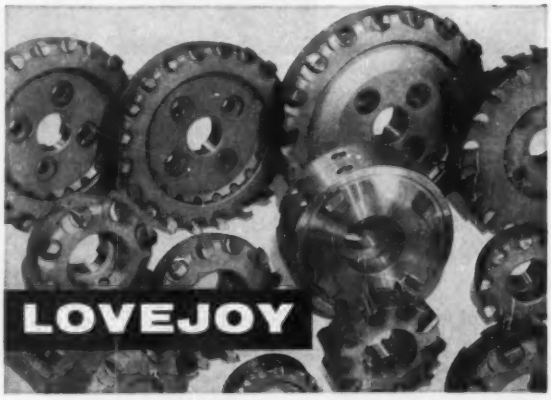


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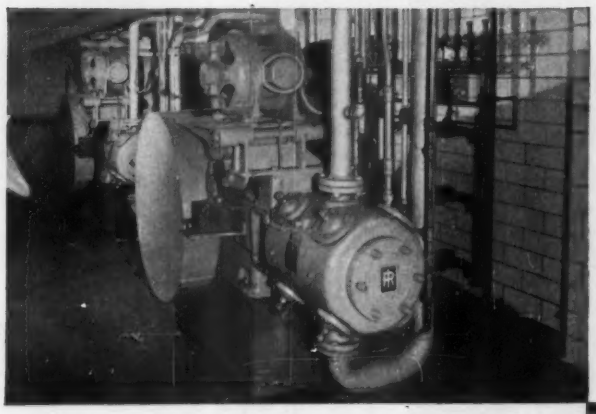

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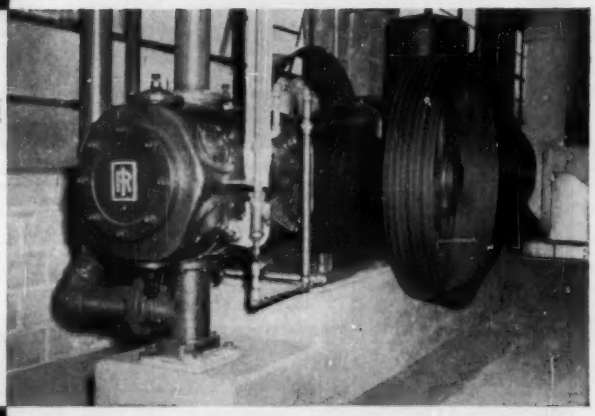
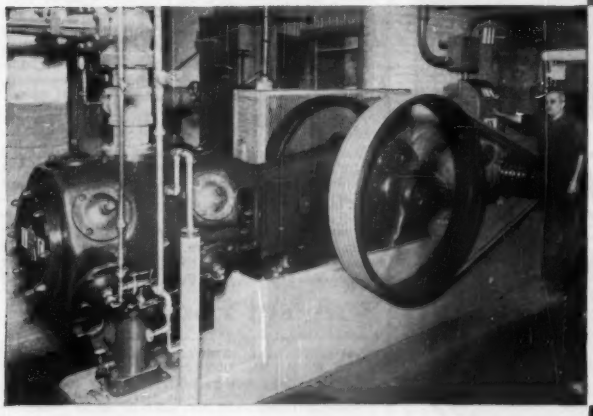


## 20 Years of Service

Installed over 20 years ago, this Ingersoll-Rand ES compressor is still in excellent condition — still doing its job dependably, compressing air to 100 psi for general shop service in a large southern manufacturing plant. ES compressors of this age are a common sight in industrial plants all over the country — attesting to the tremendous stamina and long-life built into these heavy-duty machines.



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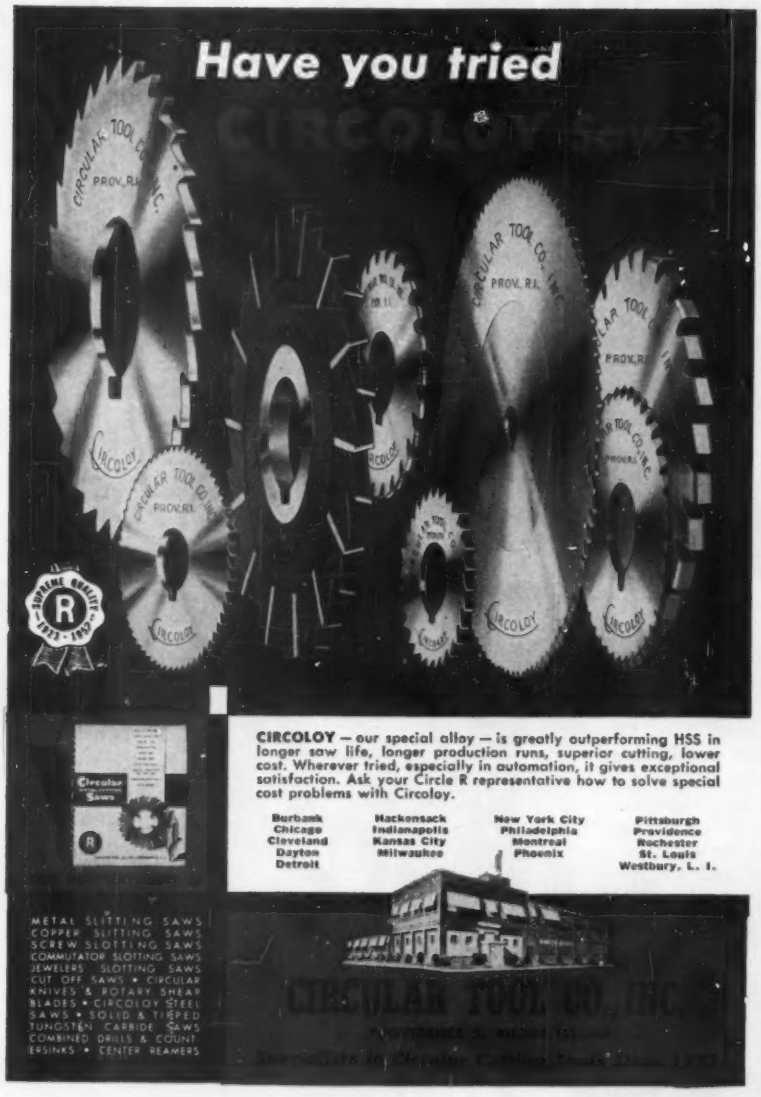
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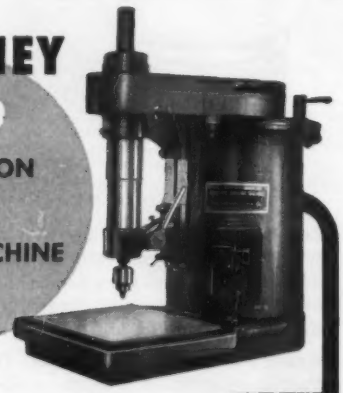

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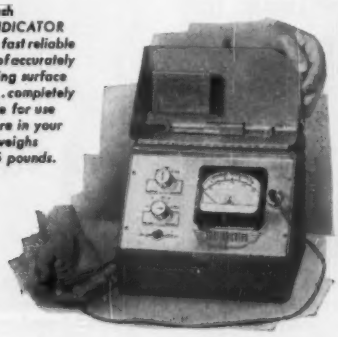

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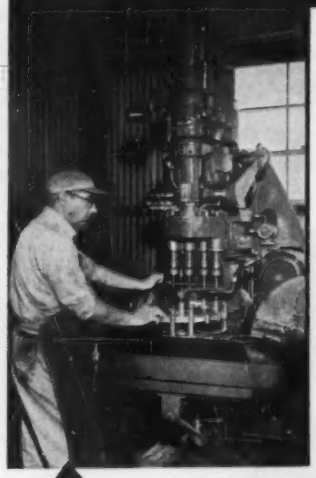

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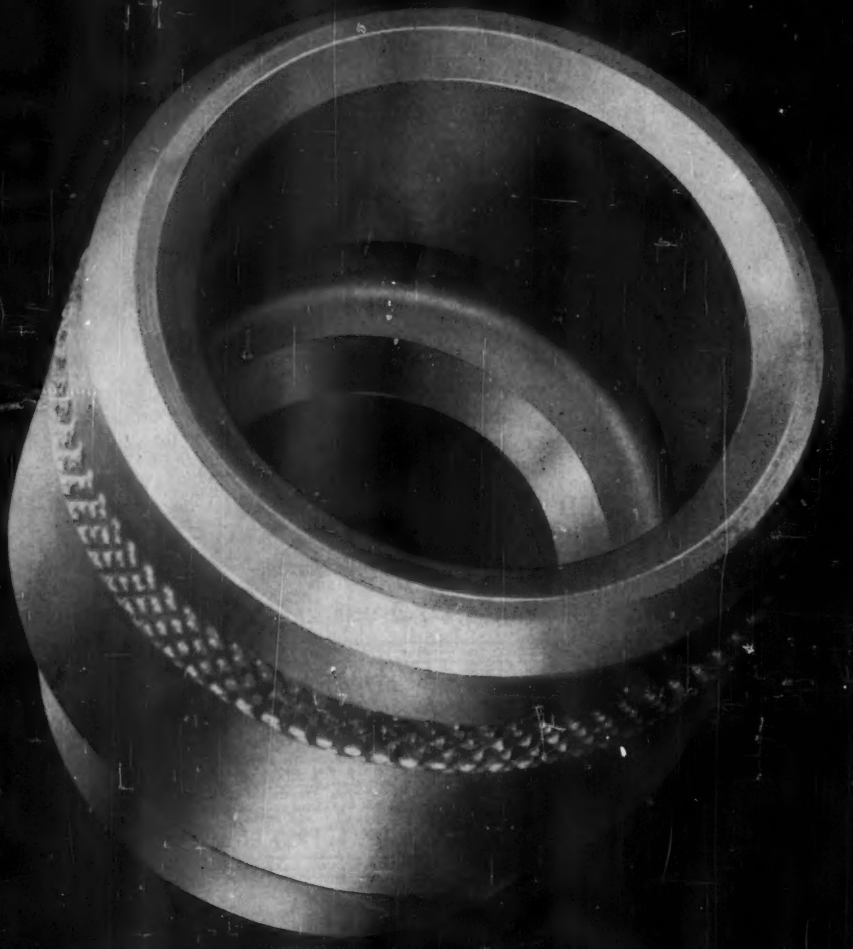

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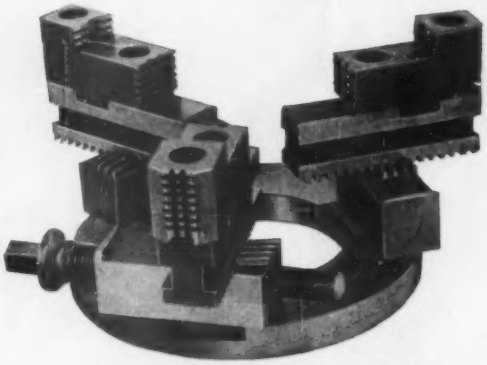

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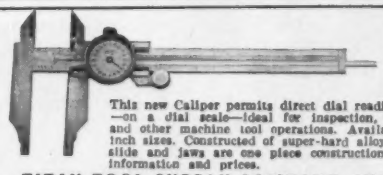

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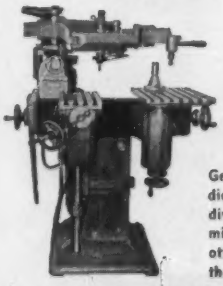

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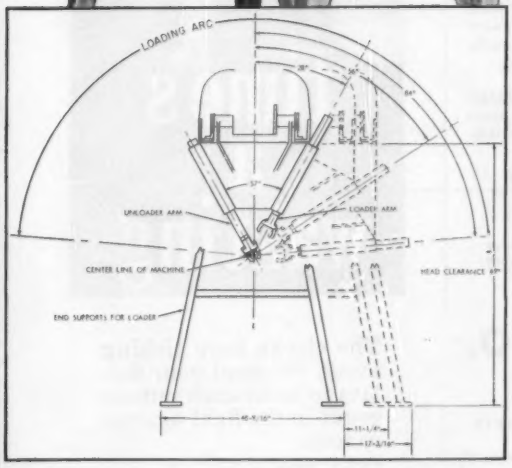


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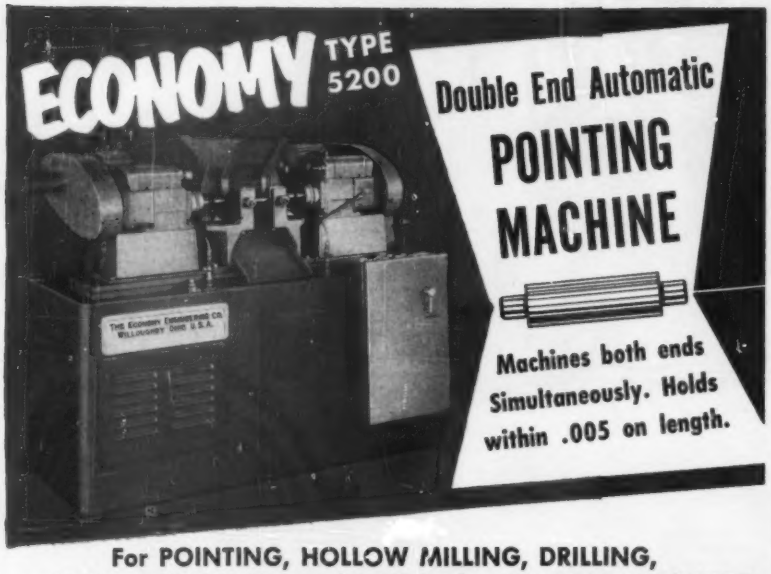
# ECONOMY TYPE 5200

## Double End Automatic POINTING MACHINE



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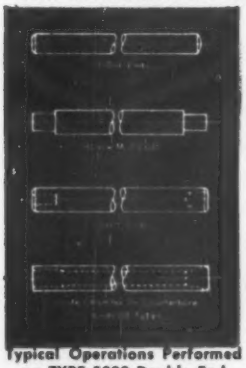

Typical Operations Performed on TYPE 5200 Double End Automatic Pointing Machines

The Type 5200 Automatic Double End Machine performs operations for which it is suited on diameters of 1/4" through 1-1/2" and lengths 1-1/2" to 30".

Production rates up to 3600 pieces per hour with a stud hopper, easily adjusted for lengths and diameters are possible. For short lengths, an independent automatic hopper feed can be provided.

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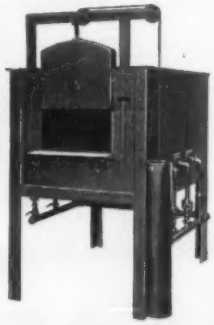

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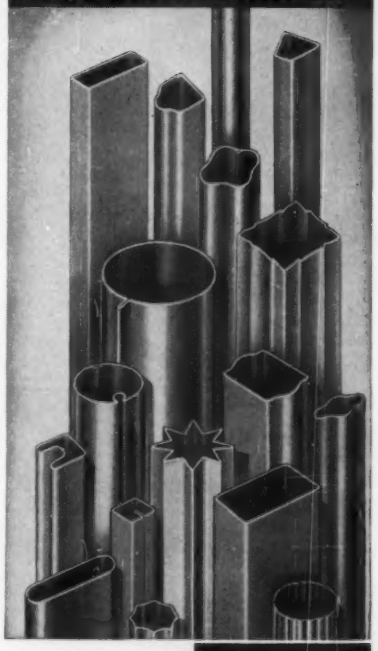

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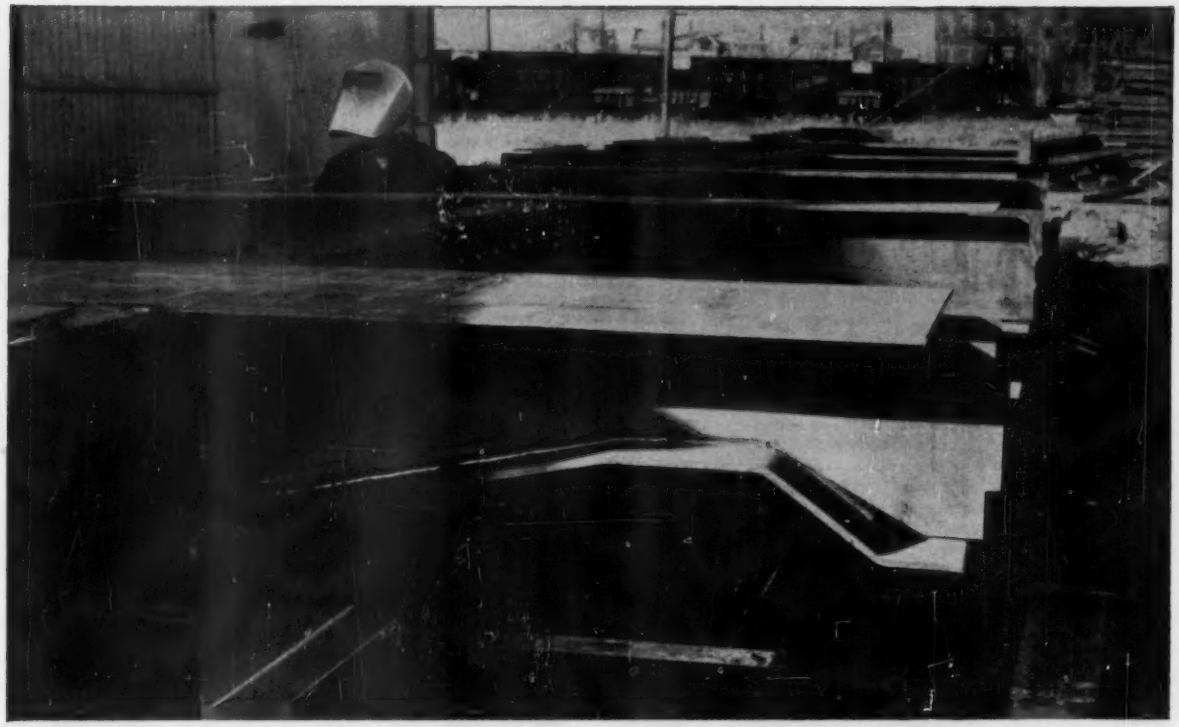

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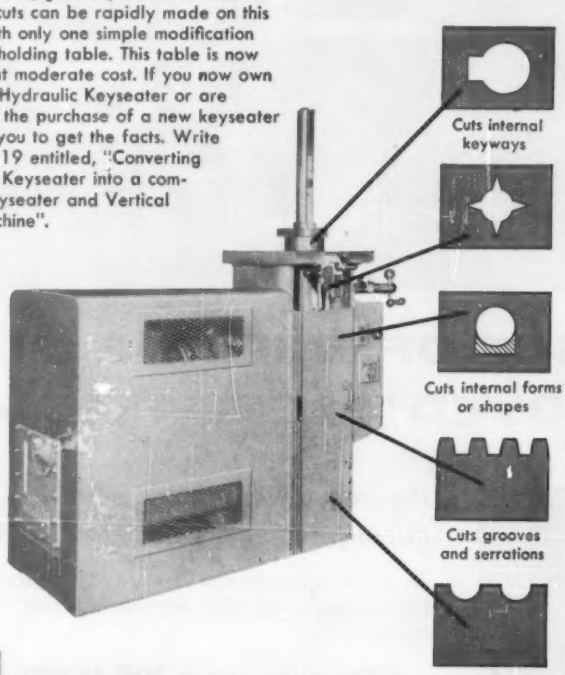


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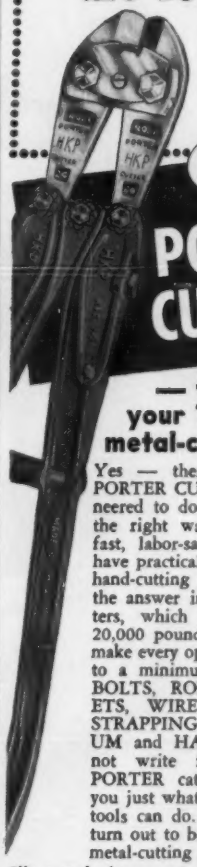
The Odds are 108 to 1! — that there's a



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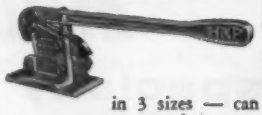

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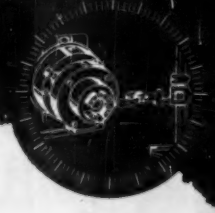

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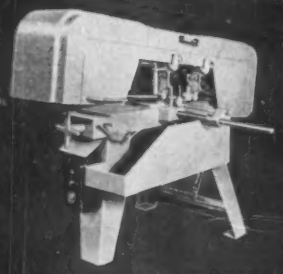
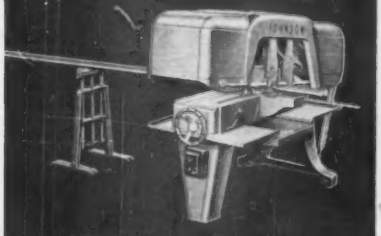


*Model B* (Wet or Dry) For precise cut-off of 5" rounds, 10" flats.



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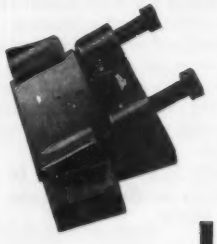

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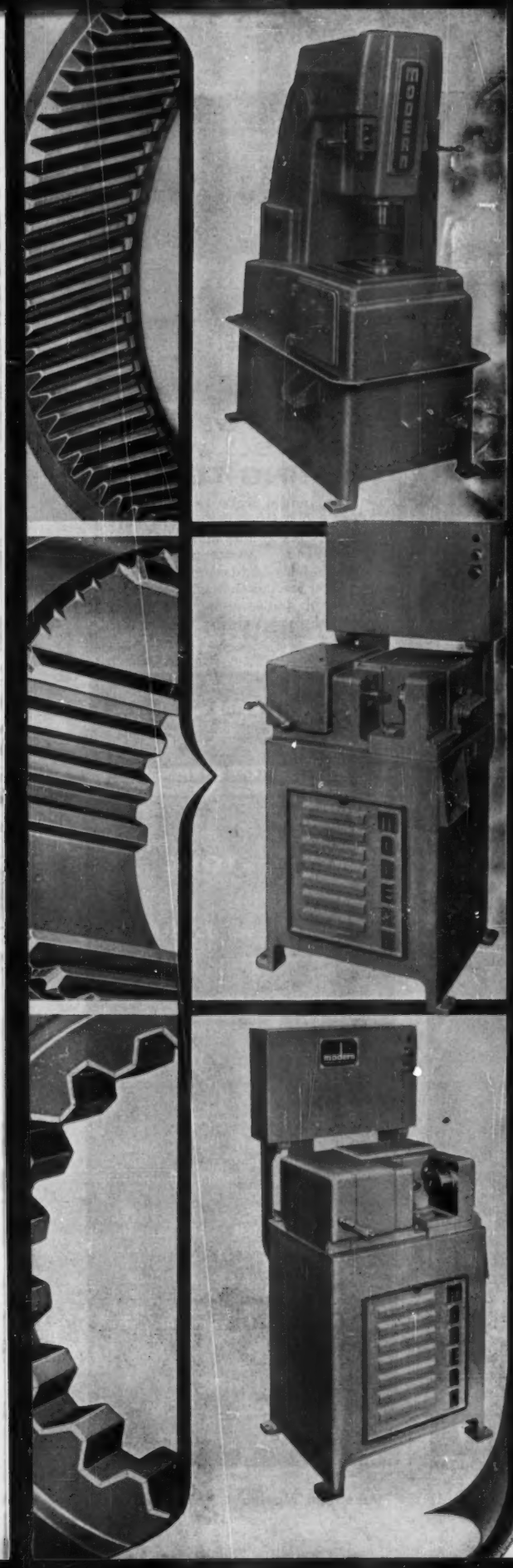

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# KEYSEATING

## The Modern Way

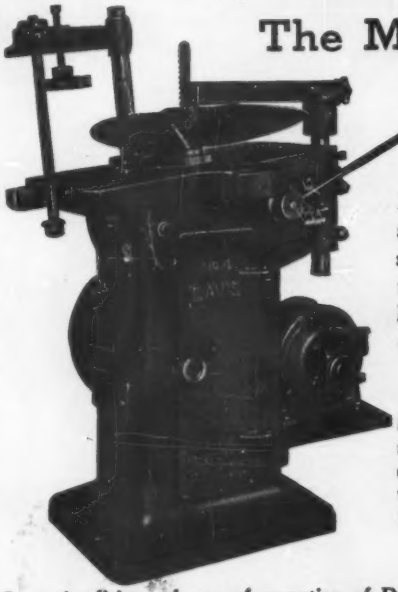

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

Great simplicity and ease of operation of Davis Keyseater, assure the user of accurate, time saving work.

*Let our engineer study your keyseating problems.*

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**Buck** AJUST-TRU **CHUCKS**

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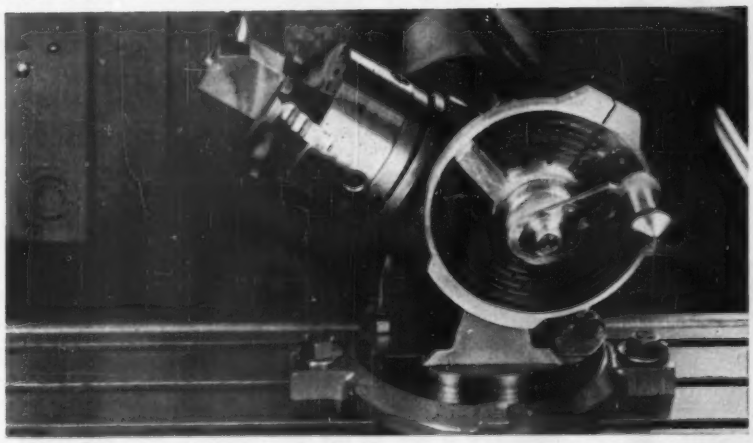


The Ellis Dividing Head is made for precision operations. The Buck 3-jaw chuck adjusts to dead true precision in 1 minute. Put the two together and you have a real performing team.

Buck Ajust-Tru chucks — 2-jaw, 3-jaw, 6-jaw — provide dead true precision and *guarantee precision within .0005" on production runs!* They help you make the most of every tool's or machine's precision capabilities.

*It pays to chuck with Buck!*

**NEW '57 CATALOG**

ready—send for your copy

**BUCK TOOL COMPANY**

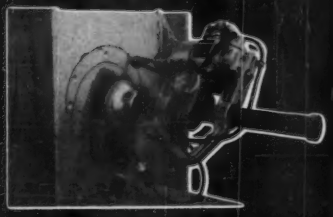
510 SCHIPPERS LANE • KALAMAZOO, MICHIGAN

ONLY

**MAG-TOOL**

HAS

MICROMATIC ADJUSTMENT



MAG-TOOL Drill Presses attach magnetically to ferrous surfaces bringing the capacity of heavy duty presses right to the job!

MICROMATIC ADJUSTMENT enables movement of the drill for precise positioning *after* the press has been attached to the working surface. For example, (see photo) the bit may be easily positioned anywhere between the two curved lines without moving the drill press.

Inquiries invited.

MAGNETIC TOOL CORPORATION

1955 Lafayette St. Santa Clara, Calif.

# A PRIME OUTLET FOR GOOD PUBLIC RELATIONS

## and a desperately-needed public service

One of the most effective public relations jobs ever accomplished was achieved last year by hundreds of companies and individual businesses of every size.

These companies have been helping to sustain an advertising campaign that performs a desperately-needed public service: It shows the American people how to drive to stay alive. It also portrays the almost unbelievable fact that more than 40,000 men, women and children were killed in traffic accidents last year—and tells what to do to help stop highway homicide.

The campaign was prepared by a volunteer advertising agency in cooperation with The Advertising Council and The National Safety Council. But the over ten million dollars worth of time and space which carry the messages to the public was contributed by media owners or sponsored by business organizations, in the public interest.

Your own plans may readily permit the inclusion of such advertising—both from the view of the vital public service it would perform, and the incalculable good will it would promote for your name, your company, and your product or service.

*To find out how easily your own program can tie in with this nationwide effort, and for the complete story on who, what, when and where, we sincerely invite you to write to The National Safety Council, Chicago 11, Illinois.*

Published in cooperation with
The National Safety Council
The Advertising Council

# Gaging . . .

## the Surplus Machinery Market

**Don't look for a business pickup** until the autumn leaves start to fall. That's the consensus of used machinery dealers coast to coast, albeit most of them are doing all right, profitwise.

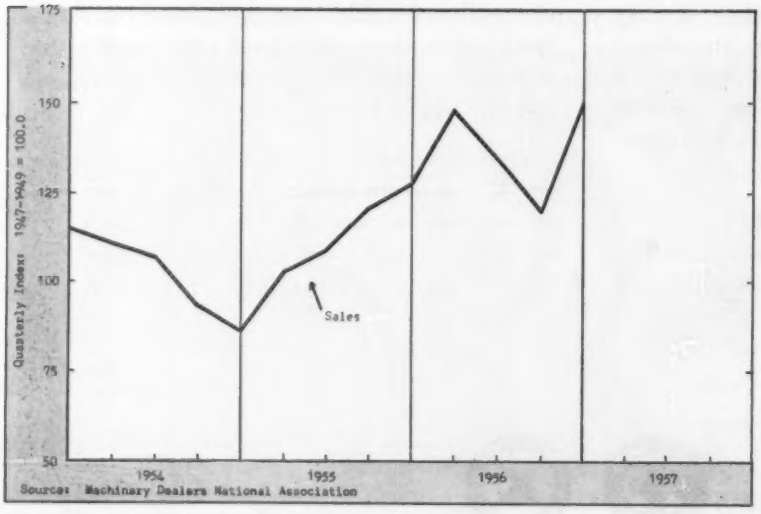
**Asked "How is the surplus machinery market doing?"** four top dealers had four different answers—"rotten," "sour and getting worse," "weakening," and "holding its own." Take your pick.

**What's the outlook?** The dealer who reports a "rotten" market says his sales are down 10-15% from a year ago, and they're still going downhill. If a pickup is due at all, it'll come after the soft summer months. While his inquiries have been pretty fair in number, he's finding it hard to close a sale. It's less because of tight money than customer hesitancy to do any large-scale buying until the market moves one way or another.

**The one who says business is "getting worse"** claims the only sales he's made recently have been special items procured at the request of one customer or another. The "market is sour" he says, and it won't pick up before fall.

**The dealer who says the market is "weakening"** admits he has been doing right well by specializing in top quality, recent-model production machine tools—concentrating his sales effort on medium and large plants.

**The "holding its own" dealer** also says he's done all right in the first quarter by "sharpening our pencils and pitching" for business. Because this outfit deals mainly with the larger metalworking plants in its area, tight money so far hasn't had much effect on sales.




**This is MDNA's new quarterly used machinery sales index . . .** Compiled by Ernst & Ernst, independent New York accounting firm, for the Machinery Dealers National Association, this index takes as its base years 1947-1949=100. As shown here, latest available figures are for fourth quarter 1956, when the index showed 149.4, compared with a third quarter 1956 figure of 119.3, and fourth quarter 1955's 127.2. Sales trend rose sharply throughout the fourth quarter. Sales figure for the first quarter of 1957 is expected to be ready sometime this month and will be shown in this column.


United
EVERY TIME!

**AUTOMATICS**
B & S 00G—High Speed—Slotting
B & S 00G Screw Threader—Vert. Slide 1950
CLEVELAND Model A 1-1/16" Single Spdl.
NEW BRITAIN #61 6-Spindle 1⅛" Stock Reel—Chip Conveyor

**BORING MILLS**
BULLARD 24" New Era—3-Jaw Chuck Table, Vert.
BULLARD 36" Spiral Drive, 3-Jaw Chuck Table, Vert.
BULLARD 42" Spiral Drive, 4-Jaw Chuck Table, Vert.

**GEAR EQUIPMENT**
BARBER COLEMAN Type S Hobber
GLEASON 6" Straight Bevel Generator
FELLOWS #61A Spur Gear Shaver

**SURFACE GRINDERS**
ABRASIVE 3B 8" x 24" Hor. Auto.
COVEL #20 6 x 18 Hor. Hydr.
DoALL D6 6 x 18 Hor. Hydr.—Selectron—Coolant—1953
NORTON 6 x 18 Hor. Hydr.
NORTON 6 x 18 Vert. Hydr.

**ENGINE LATHES**
AMERICAN 12" x 30" High Duty 12-Speed
AMERICAN 36" x 60" High Duty 12-Speed
PRATT & WHITNEY Model C 14 x 30 18-Speed
REED-PRENTICE 20" x 78" 16-Speed

**TURRET LATHES**
B & O #2 1" Ram—Bar
B & O #7 2½" Ram—Bar or Chucker
GISHOLT #3 1½" Ram—Bar or Chucker
GISHOLT #4 2" Ram—Chucker
GISHOLT #5 2½" Ram—Bar or Chucker
GISHOLT #1L 2½" Saddle—Chucker
GISHOLT #2L 3½" Saddle—Taper—Threading
W & S #2 1" Ram—El. Bar Feed
W & S #3 1½" Ram—Chucker
W & S #5 2½" Ram—Bar—Preselect.

**MILLERS**
B & S #2 Light Type Plain
B & S 3B Standard Plain—Vert. Attach.
VAN NORMAN #22L Plain

**PRODUCTION MILLERS**
CINC. #08 Plain
CINC. #2-24 Plain
CINC. #4-36 Hydromatic—2-way cycle

**PLANERS**
GRAY 36" x 36" x 12' Dbl. Housing—1 Rail, 2 Side Heads—1942

**PLANER MILLER**
INGERSOLL 42" x 42" x 14' Adj. Rail Bbl. Housing—Tubular Ways—2 Swivel Side, 2 Swivel Rail Heads

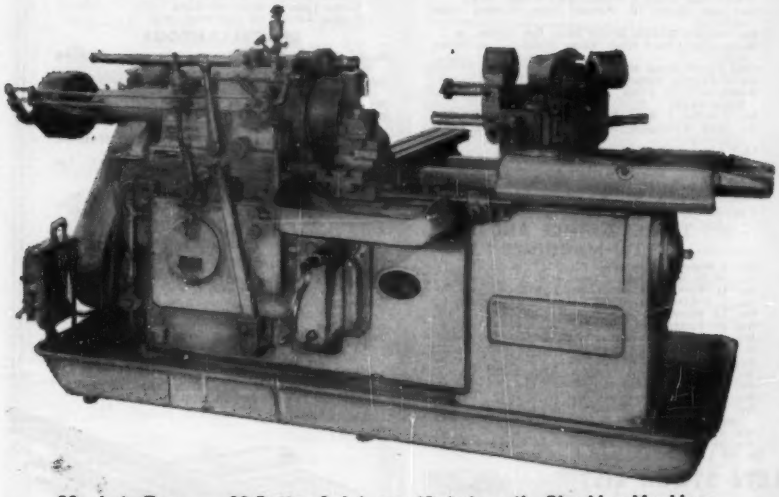
**MISCELLANEOUS**
WIEDEMANN R41P 12-TON 18-STATION Turret Punch Press
GORTON 8½D Vertical Duplicator,—Aluminum Table
PEXTO #155 Multiple Cut Slitter
PRATT & WHITNEY 12B M-1693 2 Spindle Vert. Profiler

United
MACHINERY & TOOL
CORPORATION
83 THOMAS STREET
WORCESTER 8, MASS.

· RELIABILITY
· QUALITY
· VALUE . . .

MOREY

FOR HALF A CENTURY



**20—Late Type——20 Potter & Johnson 4D Automatic Chucking Machines**
**From a Government warehouse where they were stored for the past few years.**
***Machines have seen very little service—in excellent condition!***

**BORING MILLS—VERTICAL**

BULLARD 8", 8 spindle, Type D "Mult-au-Matic"; late type.
BULLARD 16", 6 spindle, Type D "Mult-au-Matic"; late type.
BULLARD 24" Vertical Turret Lathe, spiral drive; late type.
BULLARD 36" Vertical Turret Lathe; spiral drive, with standard or extra high column; late type.
BULLARD 30" x 20" Man-Au-Trol Sunser Unit.
CINCINNATI 42", 2 swivel heads; adj. rail, M.D.; late type.
KING 36" heavy duty Vertical Turret Lathe.

**BORING MILLS—HORIZONTAL**

DETRICK & HARVEY 4" bar, floor type; M.D.
GIDDINGS & LEWIS #340T, 4" bar, table type; auto. positioning for head and table. New 1953.
HEALD #46B "Borematic", single end, single spindle; late type.
HEALD #49 "Borematic", double end, 4 spindle; late type.
LANDIS #35 floor type, 3½" bar; motor drive.
LUCAS #43 "Precision"; 4½" bar; table type with 72"x72" table, 20' to outboard support; late type.
NILES BEMENT POND 3½" bar, portable, floor type.
SELLERS 4" table type, horizontal Boring, Milling & Drilling Machine; late type.

**GEAR EQUIPMENT—FELLOWS**

FELLOWS #13-LS Gear Lapping Machine; late type.
FELLOWS #3, fine pitch; late type.
FELLOWS Type 6Z2 Gear Shaper; high speed; cap. 35" O.D., 4 D.P.
FELLOWS No. 6IA Gear Shaper; 18" O.D., ¾ D.P., late type.
FELLOWS No. 6I2 Gear Shaper; 35" O.D., ½ D.P.; late type.
FELLOWS #645A3 Gear Shaper; 18" O.D.; late type.
FELLOWS #7 High Speed Gear Shaper; cap. 7" O.D., 6 D.P.; New 1951.
FELLOWS #7A High Speed Gear Shaper; 7" O.D., 6 D.P.; late type.
FELLOWS #72 High Speed Gear Shaper; 8 D.P.
FELLOWS #75 High Speed Gear Shaper; 7" O.D., 6/8 D.P.; late type.
FELLOWS #77 High Speed Gear Shaper; 8" O.D., 8/10 D.P., helical; late type
FELLOWS #715 High Speed Gear Shaper, 7" O.D., 6 D.P., late type.
FELLOWS #12M Involute Measuring Instrument; late type.
FELLOWS #24W Involute Measuring Instrument; late type.
FELLOWS #4T Thread Generator; cap. 4"x18" centers; 3 D.P.; late type.
FELLOWS #624 Gear Shaper; 4 D.P.; late type.

**GEAR EQUIPMENT—GLEASON**

GLEASON #1 Surface Hardener late type.
GLEASON 3" Straight Bevel Gear Generator; 4-7/16" P.D., 8 D.P.; late type.
GLEASON 3" Spiral Bevel Gear Generator; 4-7/16" P.D., 12 D.P.; late type.
GLEASON #6 Straight Bevel "Revacycle", .450 D.P.; late type.
GLEASON #7 Hypoid Cutter Sharpener; late type; max. dia. 6" R or L hand.
GLEASON 11" Straight Bevel Gear Generator; M.D.
GLEASON #12 Tool Sharpener; late type.
GLEASON 12" Spiral Bevel Cutter Sharpener; max. dia. 15", m.d.
GLEASON #12 Straight Bevel Gear Rougher; 4 D.P.; late type.
GLEASON 12" Straight Bevel Gear Generator Roughing & Finishing, 3 D.P.; late type.
GLEASON #14 Hypoid & Spiral Bevel Gear Grinder; max. dia. 16"; late type.
GLEASON #16 Hypoid & Spiral Bevel Gear Generator; 2½ D.P.; late type.
GLEASON #12B Straight Bevel "Coniflex Type" Gear Generator; 3 D.P.; max. dia. 24"; late type.
GLEASON 15" Spiral Cutter Grinder; M.D.
GLEASON 15" Spiral Bevel Gear Generator; max. dia. 19¼", 3 D.P.; M.D.
GLEASON 18" Straight Bevel Gear Generator; 3 D.P.; max. dia. 20"; M.D.
GLEASON 25" Spiral Bevel Gear Generator; max. dia. 34"; 1½ D.P.; M.D.
GLEASON 25" Straight Bevel Gear Generator; max. dia. 35¼"; 1½ D.P.; late type.

**GEAR EQUIPMENT—GLEASON—Continued**

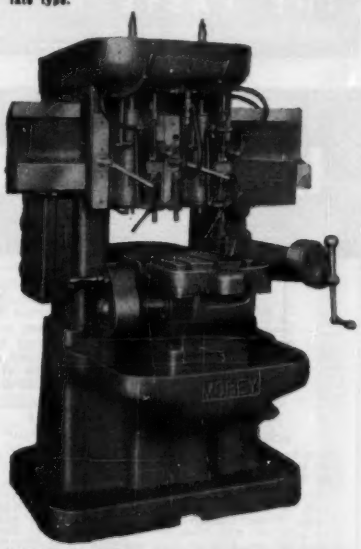
GLEASON 24" Straight Bevel Gear Planer; max. dia. 28"; 1½ D.P.; M.D.
GLEASON 32" Spur & Straight Bevel Gear Planer; max. dia. 48"; 1 D.P.; M.D.
GLEASON 54" Spur and Straight Bevel Gear Planer; max. dia. 60"; 5¾" D.P.; M.D.

**GEAR EQUIPMENT: HOBBING**

BARBER COLMAN #3 Gear Hobbing, "Precision"; cap. 5", 12 D.P.; late type.
BARBER COLMAN Type A; cap. 12"x12"; 3 D.P.; late type.
BARBER COLMAN Type T, 12"x12" cap., 3 D.P.; late type.
BARBER COLMAN #17, cap. 8", 2½ D.P., 5¾" hole thru spindle; M.D.
GOULD & EBERHARDT #8H Universal; cap. 12"; 4 D.P.; M.D.
GOULD & EBERHARDT #12H Universal; cap. 12"; 4 D.P.; M.D.
GOULD & EBERHARDT Model 24-H Universal, 27" cap., 3½ D.P.; late type.
GOULD & EBERHARDT #24H Universal; extended hob spindle.
PFAUTER (SCHUCHARDT & SCHUTTE) #1 Univ.; M.D.
KOEPFER Model WM-11 Automatic Gear Cutter; 24 D.P.; late type.
BARBER COLMAN Type S Auto. Gear Hobbing Machine #1, 1" dia., brass 24 D.P., steel 32 D.P.; late type.

**GEAR EQUIPMENT—MISCELLANEOUS**

BILGRAM 6" Bevel Gear Generator; 1 D.P.; M.D.
BILGRAM 16" Bevel Gear Generator; 2 D.P.; M.D.
BROWN & SHARPE #13 Straight & Bevel Auto. Gear Cutter; 18" cap., 4 D.P.; M.D.
CINCINNATI #4 Auto. Gear Cutter; cap. 36"; 2½ D.P.; late type.
CINCINNATI #6A Auto. Gear Cutter; cap. 72", 1½ D.P.; late type.
CROSS #1 Gear Tooth Rounding Machine; cap. 4 pitch or finer to 24" dia., 2 pitch or finer to 6" dia.
CROSS #40 Gear Tooth Pointing & Chamfering Machine; gear face 10"; gear dia. 20"; gear pitch 2 or finer.
CROSS #43 Gear Chamfering Machine; late type.
DETROIT Type GG-35 Gear Grinder; late type.
GOULD & EBERHARDT #36BM; 3 spindle Gear Rougher; 2 D.P., M.D.
GOULD & EBERHARDT #36BT Gear Rougher; 4 D.P., M.D.
MICHIGAN Model 862-24A Gear Finishing Machine; late type.
MICHIGAN Model 854 Rack Type Gear Shaver; 8" dia., 2" face; M.D.
PRATT & WHITNEY 10" Gear Grinder; single wheel type; cap. 10-11/16".
SHEFFIELD (Cimatool) #201A Auto. Burring Machine; late type.



**MOREY MODEL 12M DOUBLE SPINDLE VERTICAL PROFILER & MILLING MACHINES**

Your opportunity to acquire from the manufacturer *rebuilt Profilers* with *manufacturer's new machine guarantee* at a very substantial saving.
12 of these machines while they last!

***Write for our new catalog No. 357***

# MOREY MACHINERY CO., INC.

***MANUFACTURERS • MERCHANTS • DISTRIBUTORS OF MACHINE TOOLS***

**387 LAFAYETTE STREET • NEW YORK 3, N. Y. • TEL:—ALGONQUIN 4-6560 • CABLE-WOODWORK N.Y.**

# Eastern Rebuilt Machine Tools

## THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

### RAILROAD MACHINERY

No. 2 Niles-Bement-Pond Axle Lathe, m.d.
No. 3 Niles-Bement-Pond Axle Lathe, m.d.
52" Betts Car Wheel Borer
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
90" Niles Journal Turning Locomotive Lathe, including 2 inside journal turrets and 3½" spindle double quartering attach., m.d.
90" Niles Driving Wheel Lathe, m.d., latest
No. 3 Betts Bridgeford Axle Lathe, m.d.
600 ton Niles-Bement-Pond Wheel Press, m.d.
Chambersburg Mounting & Dismounting H.S. Duplex Car Wheel Press

### SHAPERS

6" Pratt & Whitney M1506, Model B Vertical Shaper
12" Rockford Universal Hydraulic, flanged, m.d.
12" Hendey Universal Back Geared, m.d.
16" Hendey, m.d.
16" Smith & Mills Universal, m.d.
24" Potter & Johnston, cone
24" Cincinnati Plain Standard Back Geared Crank, m.d.
32" Morton Draw-Cut, m.d., late
32" Ohio Shaper, m.d.
32" Cincinnati, m.d., late
32" Columbia H.D. Plain Back Geared Crank Shaper, m.d.
36" Morton Draw-Cut, m.d., late
36" Rockford Universal Openside Shaper-Planer, m.d.
38" Morton Push Cut Shaper, m.d.

### TAPPERS

No. 1 Bakewell, m.d., late
No. 1 Haskins, pneumatic control, type 1 CAP
No. 2 Haskins, pneumatic control, type 2 CAP
No. 3 Haskins, pneumatic control, Type 3 CAP
No. 3C Haskins, pneumatic control, type 3 CAM, m.d.
2 spindle Haskins, pneumatic control, m.d.
No. 22 Murchey, 6 to 28 pitch
3 way Natco Tapper & Drill

No. 10 Model 2100 Warner & Swasey Bench Model, m.d.

### SHEET METAL MACHINERY

No. 2 Libert Nibbler, 28" throat
No. 3½" capacity Gray Sheet Metal Cutter, m.d.
12'x⅜" cap. Dreis & Krump Leaf Brake, m.d.
Size 848 Model O Parker Tube Bender, hand operated
No. 11-SBC Buffalo Armor Plate Bar Cutter, m.d.
Model 1236 Libert High Speed Nibbler Type Shear, m.d.
Gray Turret Head Metal Cutter, m.d.
No. 3 Ryerson Rotary Bevel Shear
Model 4510-D Dreis & Krump "Chicago" Steel Press Brake
No. 5 Hilles & Jones Pyramid Type Bending Rolls
No. 1016 Wysong & Miles Power Squaring Shear, m.d.
1412 Cincinnati All Steel Shear

### PROFILERS

No. 12B Pratt & Whitney Model 1693, 2 spindle, 1944
4 spindle 360 Cincinnati Automatic, m.d., 1944

### TURRET LATHES AND SCREW MACHINES

No. 1 Warner & Swasey "Electric", m.d., bar
No. 1B-25 Acme Saddle Type, m.d.
No. 1L Gisholt Universal, m.d., 1943
No. 1, 2 Cincinnati Acme Full Universal, m.d.
No. 1A Warner & Swasey, m.d.
No. 2F Foster Fastermatic, m.d., Timken
No. 2L Gisholt Universal, m.d., latest type, 1945
No. 3 Gisholt, m.d., 1942
No. 3A Warner & Swasey, m.d.
No. 3L Gisholt, m.d., 1942
No. 3F Foster Fastermatic, m.d., Timken
No. 4 Midland Universal Ram Type, m.d.
No. 4A Warner & Swasey Universal, m.d., chucking, 1939
No. 4L Gisholt Universal, m.d.
No. 4FU Foster Fastermatic, m.d., latest, 1945
No. 4R Libby Ram Type, m.d., in base
No. 5 Gisholt Ram Type, m.d.
No. 7 Barbons & Oliver, flanged mounted m.d.
No. 7A Jones & Lamson Universal
2½x24" Jones & Lamson Geared Head, m.d., bar and chucking
4x34" Jones & Lamson Geared Head, m.d.
20" Dreses, arranged for factory, m.d.
26" Libby Type C, m.d., chucking
6.2 Denver Acme Full Universal, m.d.

### MISCELLANEOUS

Model RP Tompkins & Johnson Pneumatic Riveting Mach. with cylinder
No. 53A Sundstrand Double End Opposed Type Drilling & Centering Machine
No. 125 Marken Marking Machine, m.d.
Sciaky Type PMCO-25-31 Storage of Energy Spot Welder, 50 KW, 34" throat
Pratt & Whitney Standard Measuring Machine, 36" capacity
Type 114CB Moline Tool Boring Machine, two spindle type, m.d.
15" Gleason Quenching Press
No. 11 Cochran Bly Saw Sharpener, belt drive
Logan Hydraulic Vertical Shaper, m.d., 6" stroke
Gisholt Precision Balancing Machine, m.d.
LeRoi Electric Power Plant
36" face Plates, lathe, taper new, key mounted, new
Hanchett Grinding Head, vertical type for mounting on planer rail
24"x60" Magnetic Chuck
16"x60" O.S. Walker Magnetic Chuck
Clamping Assembly to fit a 6.2 Denver Acme Turret Lathe
1 ton Shaw Electric Cable Hoist
Brown & Sharpe Universal Attachment, for use on 2A Brown & Sharpe Miller
63" Walker Rotary Magnetic Chuck, 230 volt D.C., new
Portable Gressing Machine, motor operated
Megatherm H.S. Induction Heating Unit

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CABLE ADDRESS EMCO



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**BEST BUY OF THE MONTH**

**BEST BUY OF THE MONTH**

**42" swing x 72" centers Norton Type C Plain Cylindrical Grinder, 20HP 220/440-3-60 wheel motor drive, will grind 42" with maximum size wheel, wheel size 30" x 3", wheel head traverse 29¼", reciprocating & shoulder grinding attachment, power rapid traverse to wheel slide, 2 steady rests, electric lift 500 lb. hoist with stand, coolant serial no. C-22459 1947, replacement cost over $45,000.00 OUR PRICE $17,500.00.**

### PARTIAL LISTING

#### BORING MACHINES

Foote-Burt Vert. 24" sw. new 1941
#40 Heald Borrematic, new 1944
3⅛" Bar Clnn.-Glibert Floor Type

#### DRILLS

1 spdl. 14" sw. #2 Avey, new 1945
1 spdl. 20" sw. #2LMS L-G, 1945
1 spdl 21" sw. #112 Defiance, 1942
1 spdl. 24" sw. #2MAS Avey, new 1943
1 spdl. 26" sw. #4MS L-G hydraulic
2 spdl. 24" sw. #3 Avey, AC MD
3 spdl. 20" sw. #2LMS L-G, 1942
3 spdl. 24" sw. #3MS L-G, new 1943
6 spdl. 29" sw. #1LMS L-G, new 1943
16 spdl. For #K40H, #2 taper, 1944

#### GRINDERS

3"x12" #5 B&S, 1942
3"x18" #5 B&S, 1943
4"x12" #4H Landis, new 1942
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1941
10"x36" Norton Type C, new 1942
10" (28" sw.) x 48" Clnn. ER, 1943
10"x30" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10" x 72" Norton Hyd., 1944
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x40" #3 B&S Univ., 1943
14"x72" Norton Type C, new 1941
16"-20"x96" Norton, 1943
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, AC Mot. Dr.
16"-26"x72" Norton, AC MD 1941
18"x120" Norton, AC MD
20"-32"x1¼" Norton Pl. Cyl.
23"x36" Norton, Hi-Swing
24"x264" Norton, AC MD
42"x72" Norton, extras, new 1947
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
72A5 Heald Univ. Int., 1942
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc. 1940
#18-30" Blanchard Rot. Surf.

#### LATHES

16ML-16"x36" LeBlond Auto.
12"x28" Lipe Carbo Semi-Auto
12"x32" Fay Automatic
12"x45" Fay Automatic
24"x42" Fay Auto. AC MD
36"x126" Putnam Grd. Hd., MD
#14 Seneca Falls, 16"x36", 1942
120"x96" or N-B.-P. ser. 2380
#5W Clnn. Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1942
#4A W&S Turret Ser 338969
4FU Fastermatic, tur, 32" sw 1944
8D Potter & Johnston, new 1941

#### MILLERS

54"x30"x16" Ingersoll Slab, 1934
54"x60"x8" Ingersoll Openside, 1942
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B Thread Mill
#LT 6"x72" L-B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
#118 Van Norman Prod. 1943

#### PLANERS

60"x48"x27' American, 4 hds.
60"x48"x30 Hamilton, 4 heads

#### MISCELLANEOUS

36" Rockford Hyd. O.B. Shaper, 1950
Z36 DoALL Zephyr El-Spd. Saw, 1946
15 Ton—60" Colonial Vert. Broach
6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 3 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" com
#HRS Barber-Colman Sharp Mach
No. 2 Pfauter Gear Hobber

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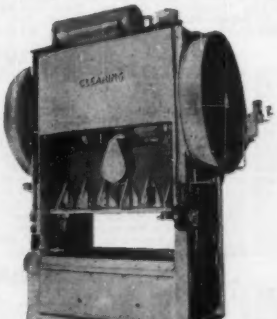

SQUARING SHEARS • PRESS BRAKES

**REBUILT and GUARANTEED**

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**FOR SALE**
**PARTS WASHING MACHINE**

Industrial; Model RWRB; Ser. No. 42-423; 2 stage; work conveyor 36" W x 15' L; steam heated; complete w/motors, pumps, blower & controls.

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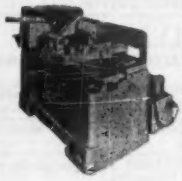
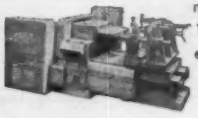
Model No. 74 Heald Hydraulic "Long Base" "Extended Bridge" Precision Internal Grinder, for work pieces of unlimited length, late style, perfect condition.

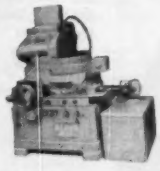


No. 281 Heald Sizematic Centerless Internal Grinder, latest style and design, maximum length of hole 4", new 1949/50.

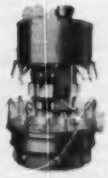
No. 521 Heald Single End Boromatic, new about 1950, 16" table travel, like new.



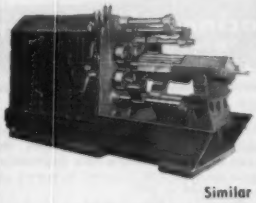
No. 122 Heald Double End Boromatic, serial number 35198, new in 1954, practically new. With one head on each bridge and hydraulic cross sliding fixture.



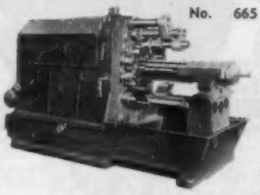
Two—#261 Heald Precision Rotary Surface Grinders, serials 33579. New in 1953. 12" diameter magnetic chucks. For grinding flat, concave and convex surfaces.



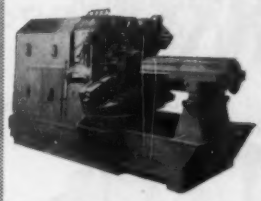
12" 8-Spindle Bullard, Model "D" Mult-Au-Matic, Serial 19002, new 1942, double index, power chucking. With four plain slides and two double compound slides.



#49 New Britain Gridley Chucker 4-Spindle, 9" capacity, new 1949. Serial #30486. In excellent condition. Similar to picture.



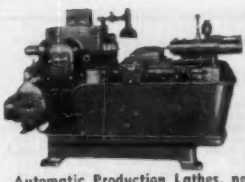
No. 665 New Britain Gridley Chucker 6-Spindle, 6½" capacity, new 1945, serial 29479. tooling. Similar to picture.



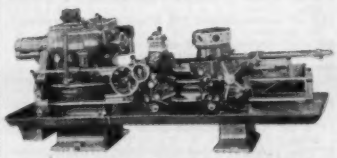
#795 New Britain Gridley Chucker, 6-Spindle, 9½" capacity, new in 1945, serial 29612. Similar to picture.

#76H Baird 6-Spindle, 7" capacity Automatic Chucker, serial 473, latest style, new 1947. Fully equipped and tooled.

4⅜" 4-Spindle Cone (Conomatic) Automatic Screw Machine, complete with bar feed, lots of tooling, very good condition, used very little.



#10 Sundstrand Automatic Production Lathes, serials 10-490, 10-534 and 10-538. Late machines. No. 12 Sundstrand Automatic Production Lathes, new 1949, serials 82-678 and 82-662.

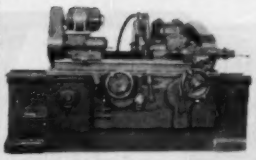


Model No. 1L Gisholt Universal Saddle Type Turret Lathe, serial 632-55, 1942, complete bar feeding mechanism and collet chuck.

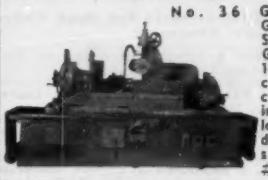
No. 1248 Kearney & Trecker Bridge Type Vertical Production Milling Machine.

Model No. 5-42 Cincinnati "Duplex" Twin-Ram Hydraulic Surface Broach.

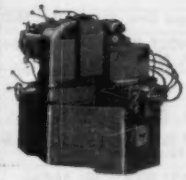
Model No. 5-54 Cincinnati "Duplex" Twin-Ram Hydraulic Surface Broach.



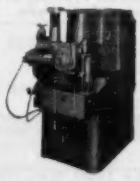
10" x 36" Norton Type "C" Plain Cylindrical Grinder, serial 16155. Completely reconditioned. Hydraulic tablefeed; hydraulic plunge-feed.



No. 36 Geargrind Gear and Spline Grinder, 18" x 42" capacity complete, in excellent condition, serial #2467.



No. 17 Gleason Hydraulic Hypoid Gear Tester/Lappers, Fully equipped, with oscillating spindles, hydraulic clamping. Serials 15425 and 15426.

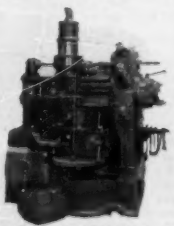


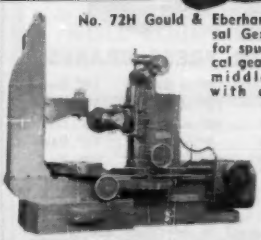
Gleason Hypoid Group, consisting of a No. 7 Hypoid Generator, No. 107 Cutter Sharpener and a No. 6 Angular Hypod Tester, all new in 1952, in "unused" like condition.

No. 13 Gleason Universal Gear Tester, used for less than one year on hand rolling only, with spindle-oscillation, like new.

Fellows Gear Shapers:

Models 61, 61A, 75 and 715 Fellows Gear Shapers. These are of the latest type, equipped, standard, excellent condition throughout. Ask for detailed quotations.





No. 72H Gould & Eberhardt Universal Gear Hobber, for spur and helical gears. New in middle 1930's, with outboard support, change gears, motor. Max. dia. of gear without outboard support 78".

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No. 2HL KEARNEY & TRECKER Horiz. Mill, M.D., Late Type.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late

No. 2, 3, 4, 5 CINCINNATI HI Power Horiz. Mills, M.D. Rect. Overarms.

No. 2, No. 3 CINCINNATI H5DT Horiz. Mills, Vert. Heads Extra Table Travel, 1945.

No. 1-14 KENT-OWENS Hydraulic Prod. Mills M.D., Late Type.

No. 4 CINCINNATI HI Power Vert. Mill, 1942.

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16" x 36" Norton type C plain cylindrical grinder
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No. 72A3 Heald Gagematic internal grinder
No. 72A5 Heald Universal plain hydraulic internal grinder
No. 74 Heald hydraulic plain internal grinder, cross sliding headstock
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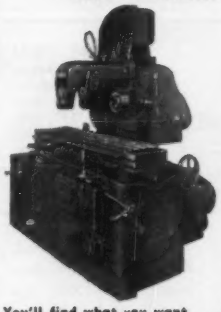

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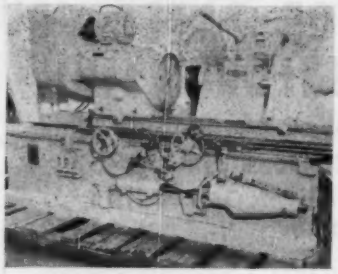

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## Index of PRODUCTS ADVERTISED In This Issue


Abrasives, Coated ..... 39

Accessories & Attachments (Machine Tool) ..... 42, 156, 209, 237, Insert Bet. 240-241, 266, 280, 282, 293

Bearings ..... 50, 106, 203

Bending Machines ..... 228

Books, Technical ..... 260

Boring, Drilling & Milling Machines (Horizontal) ..... 14-15

Boring Machines Internal ..... 2nd Cover, 32, Insert Bet. 32-33, 33, 67, 98

Boring & Turning Machines (Vertical) ..... 100

Broaching Machines ..... 26-27, 154, 196

Brushes ..... 176B

Catalogs ..... 271

Chucks ..... 92, 208, 239, 260, 268, 279

Collets ..... 279

Compressors, Air ..... 261

Controls, Electrical ..... 84, 205, 235

Coolant Systems, Filters & Supplies 230

Cut-Off Machines ..... 110, 112, 278, 294

Die Sets ..... 193, 242

Drilling Machines ..... 41, 58, 77, 91, 109, 153, 210-211, 243, 264, 266

Duplicators & Pantographs ..... 32, Insert Bet. 32-33, 33

Engineering & Production Services 213

Fabricating Methods & Services 213, 233

Fasteners ..... 3rd Cover, 64B, 156, 181

Files, Hand ..... 236

Gages, Instruments & Testing Equipment ..... 44, 69, 72-73, 160, 177, 194, 200, 209, 223, 231, 244, 252, 265, 268, 272, 297

Gear Cutting Machines ..... 3, 6-7, 85, 154, Insert Bet. 208-209, 255, 281


(*Continued on page 292*)


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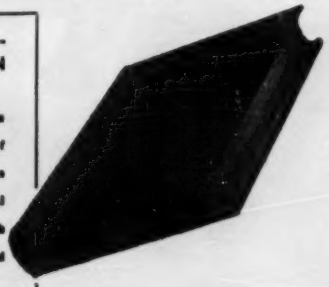

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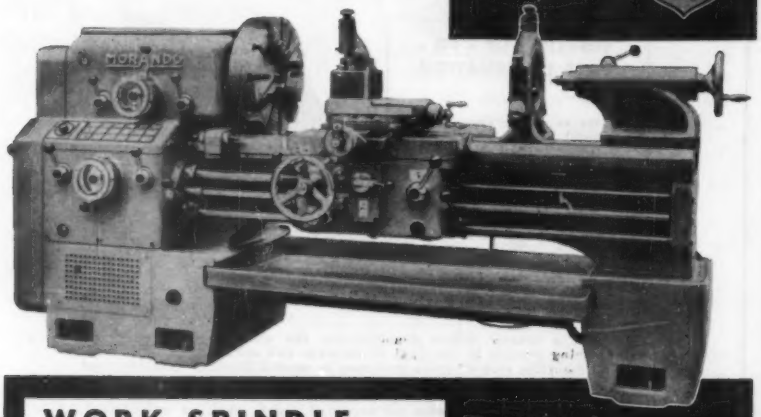


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**Index of**
## PRODUCTS ADVERTISED
**In This Issue**

•

(*Continued from page* 291)


Gears, Speed Reducers, Motor Reducers ..... 61, 270

Gear Testers ..... 3, 6-7, 154, 183

Grinders—Cutter & Tool ..... 30-31, 206-207, 270, 295, 300

Grinding Machines—Production 12-13, 16-17, 18-19, 33, 206-207, 274, 300

Grinding Wheels ..... 30-31, 43, Insert Bet. 48-49, 80, 217, 218-219

Heads: Drilling, Grinding & Tapping ..... 38, 248, 264, 266, 282

Heat Treating Equipment & Supplies ..... 79, 272

Honing Machines ..... 198-199, 245

Hydraulic & Pneumatic Parts & Equipment ..... 51, 63, 208, 259, 262

Jig Borers ..... 200, 227, 293

Keyseaters ..... 266, 276, 282

Lathes, Automatic ..... 52-53

Lathes, Engines ... 32, Insert Bet. 32-33, 33, 81, 86-87, 93, 104-105, 191, 292

Lathes, Turret ..... 35, 36, 48, 100

Lubricants, Cutting Fluids, Quenching Oils & Solvents ... 20-21, 34, 197, 201, 212, 246, 251, 264

Lubricating Systems & Equipment 263

Materials, Cutting & Forming ..... 4th Cover, 47, 82-83, Insert Facing 176, 187, 229, 232, 237, Insert Bet. 272-273

Materials of Manufacture ... 22-23, 49, 56-57, 68, 76, 179, 189, 222, 225, 267, 295

Materials Handling Equipment .... 78

Millers, Die Sinkers, Profilers ..... 4-5, 8-9, 66, 93, 268, 273

Planers ..... 88-89

## Index of PRODUCTS ADVERTISED

### In This Issue


Polishing & Buffing Machines & Supplies ..... 216, 252

Power Transmission ..... 102

Presses, Forging & Forming Equipment & Supplies ..... 96, 110, 112, 195, 238, 240, 249, 250, 256, 268, 272, 277, 294

Riveting Machines ..... 297

Safety & Welfare Equipment ..... 60

Saw Blades ..... 59, 62, 64, 234, 262

Sawing Machines ..... 64, 215, 247, 250, 280

Screw Machines; Chucking Machines ..... 32, Insert Bet. 32-33, 33, 45, 46, 65, 185, 220-221, 224

Shapers & Slotters ..... 93, 112, 253

Special Machine Tools ..... 28-29, 54-55, 94-95, 202, 213, 269

Spindles, Machine ..... 158

Stampings ..... 204, 241

Tapping Attachments ..... 248, 296

Tapping Machines ..... 58, 266

Thread Cutting Machines ..... 10-11, 90, 299

Thread Rolling Machines & Tools 10-11

Tooling Set-up Equipment ..... 42, 209, 279, 298

Tools, Cutting ..... 24-25, Insert Facing 64, 70-71, 74, 82-83, 214, 226, 232, 237, Insert Bet. 240-241, 250, 254, 257, 258, 260, 271, Insert Bet. 272-273, 278

Tools, Hand ..... 262, 278

Tools, Measuring ..... 268

Transportation ..... 75

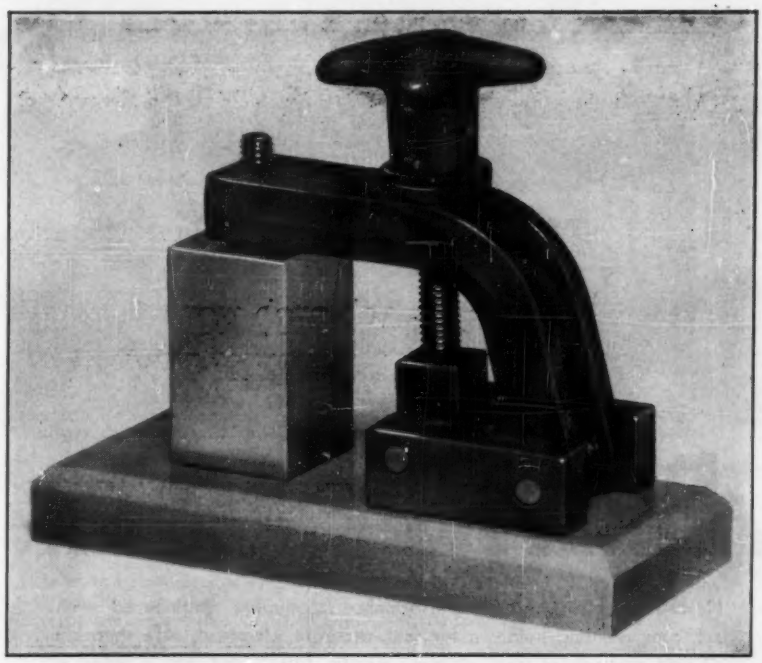
Used & Surplus Equipment ..... 284-290

Vibration Control & Mountings .... 192

Vises ..... 280, 296

Welding & Cutting Equipment & Supplies ..... 40, 233, 275





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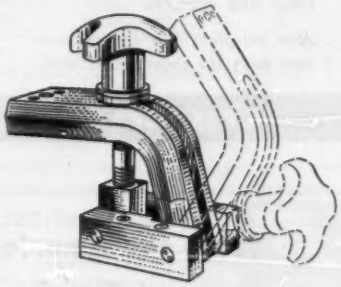

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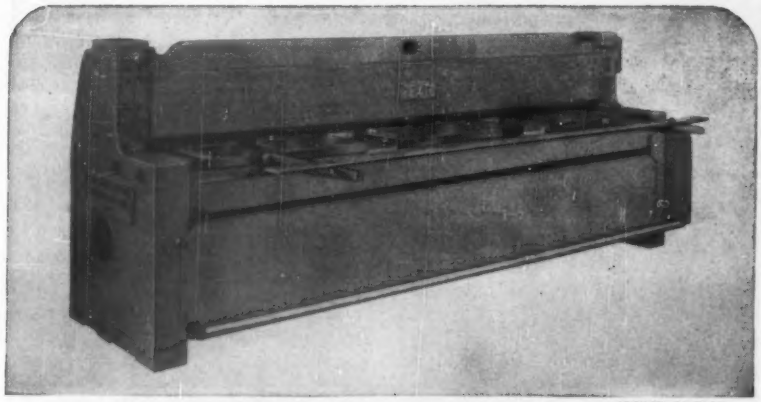

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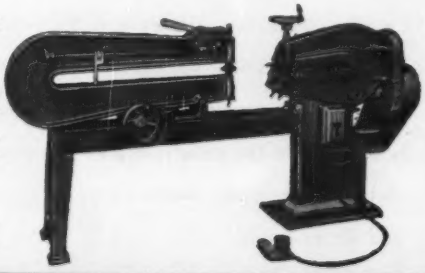

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## INDEX TO ADVERTISERS

*This index is published as a convenience to the readers. Every care is taken to make it accurate, but AMERICAN MACHINIST assumes no responsibility for errors or omissions.*


| | Page |
|---|---|
| Ace Drill Corporation | 250 |
| Alemite | 263 |
| American Brass Company | 225 |
| American Chain & Cable Co., Inc. | 78, 272 |
| American Optical Company | 60 |
| American Sip Corporation | 200 |
| American Steel Foundries, Elmes Engineering Division | 96 |
| American Steel & Wire Division | 49 |
| American Tool Works Co. | 77 |
| Ames Company, B.C. | 223 |
| Armstrong Blum Mfg. Company | 64 |
| Armstrong Brothers Tool Company | 42 |
| Arter Grinding Machine Company | 284 |
| Atlantic Refining Company | 246 |
| Baker Brothers Inc. | 202 |
| Barber-Colman Co. | 70-71 |
| Barnes Drill Company | 198-199 |
| Bath Company, Cyril | 238 |
| Bay State Abrasive Products Co. | 218-219 |
| Beatty Machine & Mfg. Co. | 266 |
| Bethlehem Steel Company | 47 |
| Bilgram Gear & Machine Company | 270 |
| Blake Co., Edward | 295 |
| Blanchard Machine Co. | 80 |
| Bridgeport Machines, Inc. | 273 |
| Brown & Sharpe Mfg. Co. | Insert Facing 64, 69 |
| Brush Electronics Company | 265 |
| Bryant Chucking Grinder Co. | 220-221 |
| Buck Tool Company | 278, 282 |
| Buffalo Forge Co. | 210-211 |
| Bullard Co. | 100 |
| Burg Tool Mfg. Company | 109 |
| Capewell Mfg. Co. | 59 |
| Carborundum Company | Insert Bet. 48-49, 68 |
| Card Mfg. Co., S. W. | 74 |
| Cargill-Detroit Corporation | 244 |
| Chandler Tool Company | 264 |
| Cincinnati Grinders Incorporated | 16-17 |
| Cincinnati Lathe & Tool Co. | 41 |
| Cincinnati Milling Machine Co. | 4-5 |
| Cincinnati Shaper Company | 112 |
| Circular Tool Company | 262 |
| Cities Service Oil Co. | 34 |
| Clark Cutler McDermott Co. | 192 |
| Cleveland Automatic Machine Co. | 45 |

# INDEX TO ADVERTISERS


| | Page |
|---|---|
| Cleveland Crane & Engineering Co. | 110 |
| Columbia-Geneva Steel Div. | 49 |
| Columbus Die-Tool & Machine Co. | 213 |
| Cone Automatic Machine Co. | 65 |
| Cross Co. | 28-29 |
| Crucible Steel Co., of America | 76 |
| Cuno Engineering Corp. | 230 |
| Davis & Thompson Company | 299 |
| Davis Keyseater Company | 282 |
| Dayton Rogers Mfg. Co. | 241 |
| Deakin & Son, J. Arthur | 268 |
| Delta Power Tool Division Rockwell Mfg. Co. | 243 |
| Denison Engineering Company | 277 |
| Detroit Die Set Corp. | 193 |
| Diamonite Products Div. U.S. Ceramic Tile Company | 237 |
| Henry Disston, Div. of H. K. Porter Co., Inc. | 234 |
| DoAll Company | 247 |
| Dow Corning Corporation | 264 |
| du Mont Corporation | 90 |
| Eastman Kodak Co. X-Ray Div. | 177 |
| Economy Engineering Co. | 270 |
| Elmes Engineering Div. American Steel Foundries | 96 |
| Erickson Tool Company | 279 |
| Errington Mechanical Laboratory | 248 |
| Esso Standard Oil Co. | 212 |
| Ex-Cell-O Corporation | 67, 98 |
| Fafnir Bearing Company | 50 |
| Fawick Airflex Division Fawick Corporation | 102 |
| Fellows Gear Shaper Company | 6-7 |
| Field & Son, Walter W. | 280 |
| Foote-Burt Company | 153 |
| Ford Mfg. Co., M. A. | 226 |
| Forkardt K. G., Paul | 268 |
| Gallmeyer & Livingston Co. | 300 |
| Gear Grinding Machine Co. | 185 |
| General Electric Apparatus Dept. | 40, 79, 84 |
| Giddings & Lewis Machine Tool Company | 14-15 |
| Gisholt Machine Company | 52-53 |
| Gleason Works | 3 |
| Goss & DeLeeuw Machine Company | 224 |
| Grant Mfg. & Machine Company | 297 |


(*Continued on page* 296)


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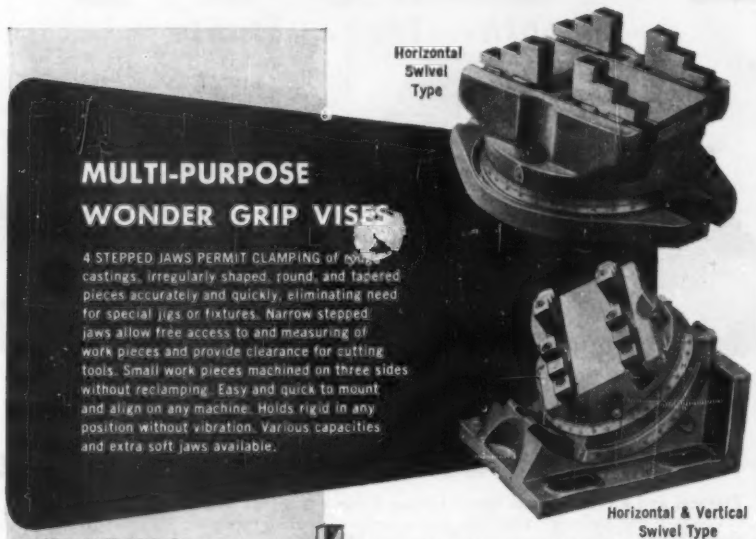


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# INDEX TO ADVERTISERS

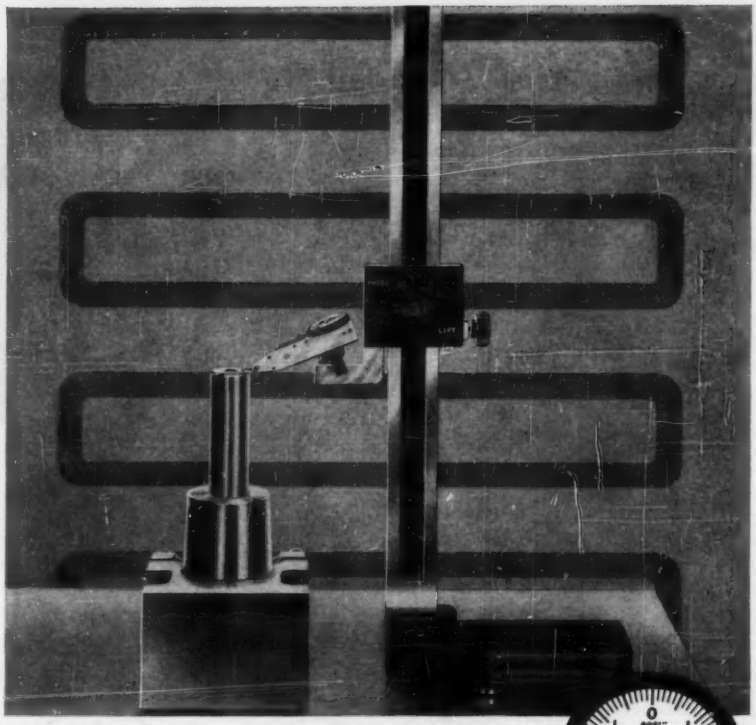
(*Continued from page* 295)


| | Page |
|---|---|
| Greenlee Brothers & Co. | 45 |
| Hannifin Corp. | 63, 250 |
| Hardinge Brothers, Inc. | 66 |
| Hartford Special Machinery Co. | 94-95 |
| Haynes Stellite Co., Div. Union Carbide & Carbon Co. | 229 |
| Heald Machine Co. Sub. Cincinnati Milling Machine Co. | 2nd Cover |
| Hill Acme Company, Acme Machine Div. | 266 |
| Holo-Krome Screw Corporation | 3rd Cover |
| Hones Inc., Charles A. | 272 |
| Illinois Gear & Machine Company | 61 |
| Ingersoll-Rand Co. | 261 |
| Inland Steel Company | 179 |
| Jacobs Mfg. Company | 239 |
| Johnson & Bassett Inc. | 298 |
| Johnson Mfg. Corp. | 280 |
| Johnson & Son, Inc., S. C., Insert Facing | 176 |
| Jones & Lamson Machine Co. | 48 |
| Jones & Laughlin Steel Corp. | 267 |
| Kaufman Mfg. Co. | 266 |
| Kearney & Trecker Corp. | 54-55 |
| Kennametal Inc. | 187 |
| Kingsbury Machine Tool Corp. | 58 |
| Kling Bros. Engineering Works | 256 |
| Knight Machinery Co., W. B. | 227 |
| Laminated Shim Co., Inc. | 204 |
| Landis Machine Company | 10-11 |
| Landis Tool Company | 12-13, 37 |
| LaPointe Machine Tool Company | 26-27, 196 |
| LeBlond Machine Tool Co., R. K. | 86-87 |
| Leland-Gifford Company | 91 |
| Lincoln Electric Company | 275 |
| Linley Brothers Co. | 293 |
| Lodding, Inc. | 293 |
| Lodge & Shipley Company | 81 |
| Lovejoy Tool Co., Inc. | 260 |
| Lufkin Rule Co. | 209 |
| Macklin Company | 217 |
| Madison Industries, Inc. | 257 |

# INDEX TO ADVERTISERS


| | Page |
|---|---|
| Magnetic Tool Corp. | 282 |
| Mahon Company, R. C. | 233 |
| Maschinenfabrik Lorenz A. G. | 255 |
| Maserati Corporation | 292 |
| M.B.I. Export & Import Ltd. | 296 |
| McGill Mfg. Co. | 203 |
| Metallurgical Products Dept., General Electric Company | 82-83 |
| Michigan Tool Company Insert Bet. | 208-209 |
| Micro Switch Div. Minneapolis-Honeywell Regulator Co. | 235 |
| Miller Corporation, Harry | 251 |
| Minnesota Mining & Mfg. Co. | 39 |
| Mitts & Merrill | 276 |
| Modern Industrial Engineering Co. | 281 |
| Monarch Machine Tool Company | 104-105 |
| Morse Twist Drill & Machine Co. | 24 25 |
| Motch & Merryweather Machinery Co. | 253 |
| Mueller Brass Company | 56-57 |
| Murray Way Corp. | 216 |
| National Acme Company | 38 |
| National Broach & Machine Co. | 154 |
| Nelco Tool Inc. Insert Facing | 64 |
| National Tube Division | 49 |
| New Britain Machine Company, The Insert Bet. | 32, 32-33, 33 |
| New Departure Div., General Motors Corp. | 106 |
| Nicholson File Company | 236 |
| Nilson Machine Co., A. H. | 240 |
| Northfield Foundry & Machine Co. | 266 |
| Norton Company | 18-19, 30 31 |
| Oliver Instrument Company | 206-207 |
| Oneida Machine Tool Corporation | 260 |
| O'Neil-Irwin Mfg. Co. | 228 |
| Optical Gaging Products, Inc. | 194 |
| Orban Co. Inc., Kurt | 183 |
| Osborn Mfg. Co. | 176B |
| Packer Machine Co. | 252 |
| Peck, Stow & Wilcox Co. | 294 |
| Pioneer Aluminum, Inc. | 295 |
| Pipe Machinery Company | 160 |
| Pope Machinery Corp. | 158 |
| Porter, Inc., H. K. | 278 |
| Producto Machine Co. | 242 |
| Railway Express, Air Express Div. | 75 |
| Reich, Mfg. Co., J. R. | 268 |
| Republic Steel Corp. | 22-23 |
| Rockford Machine Tool Company | 88-89 |
| Rockwin Manufacturing Co. | 262 |
| Rodgers Hydraulic Inc. | 195 |


(*Continued on page* 298)

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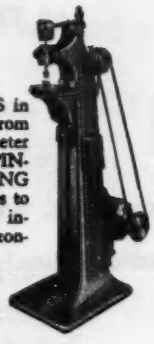

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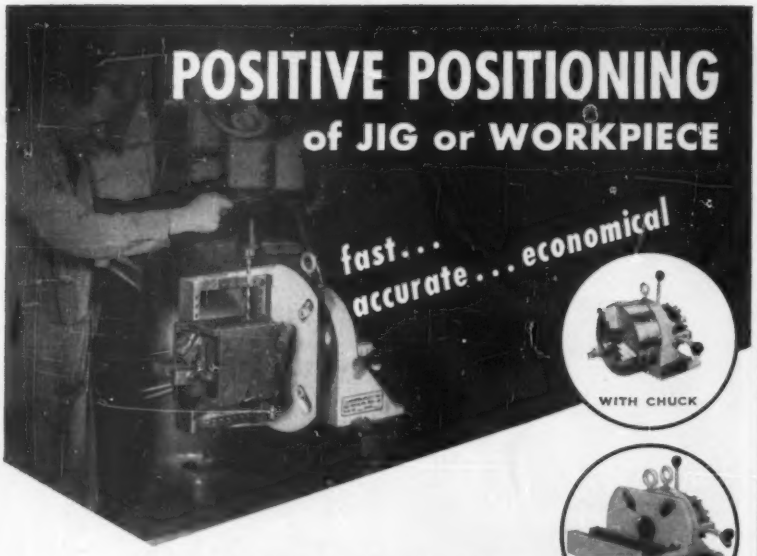


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## INDEX TO ADVERTISERS

(*Continued from page 297*)


| | Page |
|---|---|
| S. P. Manufacturing Corp. | 208 |
| Scherr Co. Inc., George | 252 |
| Schrader's Son A. Div. Scovill Mfg. Co., Inc. | 51 |
| Seneca Falls Machine Company | 269 |
| Sheffield Corp. | 85 |
| Sheldon Machine Company | 93 |
| Shell Oil Co. | 197 |
| Sigourney Tool Company | 264 |
| Simonds Abrasive Co. | 43 |
| Simonds Saw & Steel Company | 62 |
| Sossner Tap & Tool Co. | 258 |
| South Bend Lathe Works | 191 |
| Sperry Products Inc. | 282 |
| Square D Co. | 205 |
| Standard Gage Company | 297 |
| Standard Pressed Steel Co. | 64B |
| Steelweld Machinery Division, Cleveland Crane & Engineering Co. | 110 |
| Stewart-Warner Corp. | 263 |
| Stuart Oil Co. Ltd., D. A. | 20-21 |
| Stupakoff Div. of Carborundum Co. | 232 |
| Sunnen Products Company | 245 |
| Sun Oil Company | 201 |
| Taft-Peirce Mfg. Co. | 72-73 |
| Tannewitz Works, Inc. | 250 |
| Tennessee Coal & Iron Div. | 49 |
| Threadwell Tap & Die Corp. | 271 |
| Timken Roller Bearing Company | 4th Cover |
| Titan Tool Co. | 268 |



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**England** . . . Herbert Lagler, McGraw-Hill House, 95 Farringdon St., London, E. C. 4

# INDEX TO ADVERTISERS


| | Page |
|---|---|
| Union Carbide & Carbon Corp. | 229 |
| U.S. Steel Corp. | 49 |
| United States Steel Export Co. | 49 |
| United Stated Steel Supply Division | 49 |
| V & O Press Company Div., Emhart Mfg. Co. | 249 |
| Vaill Engineering Company | 268 |
| Valenite Metals Corp. | Insert Bet. 272-273 |
| Vanadium Alloys Steel Co. | 189 |
| Van Keuren Co. | 44 |
| Van Norman Machine Co. | 8-9 |
| Vickers, Inc., Div. of Sperry-Rand Corporation | 259 |
| Vlier Engineering, Inc. | 156 |
| Waldes Koh-I-Noor Inc. | 181 |
| Walker Co., Inc., O. S. | 92 |
| Warner & Swasey Company | 35, 36 |
| Webber Gage Company | 231 |
| Wells Mfg. Co. | 215 |
| Wendt-Sonis Company | 214 |
| Wesson Co. | Insert Bet. 240-241 |
| Wheelock Lovejoy & Co., Inc. | 222 |
| Whistler & Sons, Inc., S. B. | 260 |
| Whitman & Barnes Inc. | 254 |
| Wilson Mechanical Instrument Div., American Chain & Cable Co. | 272 |
| Yoder Company | 272 |


## CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.


EMPLOYMENT OPPORTUNITIES ..... 290

EQUIPMENT
(Used or Surplus New)
For Sale ..... 284-290


ADVERTISERS INDEX


| | |
|---|---|
| Ajax Engineering | 290 |
| Bennett Machinery Co. | 289 |
| Clifton Hydraulic Press | 289 |
| Cincinnati Machinery Co., Inc. | 289 |
| Commercial Equipment Co. | 289 |
| Di Mattera Co., The | 289 |
| Dony Machinery Co., D. E. | 289 |
| Eastern Machinery Co. | 286 |
| Eastern Machine Screw Corp. | 289 |
| Ernest Holdeman & Collett | 289 |
| Falk Machinery Co. | 288 |
| Globe Trading Co. | 289 |
| Hill-Clarke Machinery Co. | 286 |
| Hyman & Sons, Joseph | 286 |
| Lathe | 289 |
| Laurens Bros. Inc. | 287 |
| Machine Tool Publications | 290 |
| Miles Machinery Co. | 288 |
| Morey Machinery Co., Inc. | 285, 289 |
| Noll Equipment Co. | 289 |
| Nordeman Publishing Co. | 290 |
| Press & Shear Machinery Corp. | 288 |
| Sier Bath Gear & Pump | 289 |
| Sussman, Martin J. | 290 |
| United Machinery & Tool Corp. | 284 |
| Wolco Equipment Co. | 286 |



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Here's another example of Davis and Thompson Engineering of high production with a minimum of equipment. This GG-8 horizontal threader is equipped with 4 spindles in each head and a 4 station fixture. It is one of countless threading machines that have been designed and built by Davis & Thompson since 1924. Both single and double end machines for pipe, conduit, shafts and similar parts in various production quantities have been produced.

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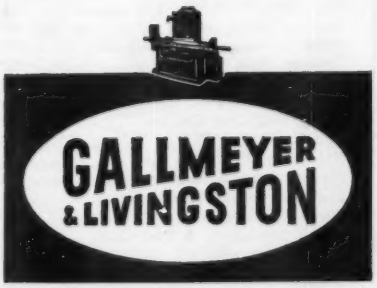
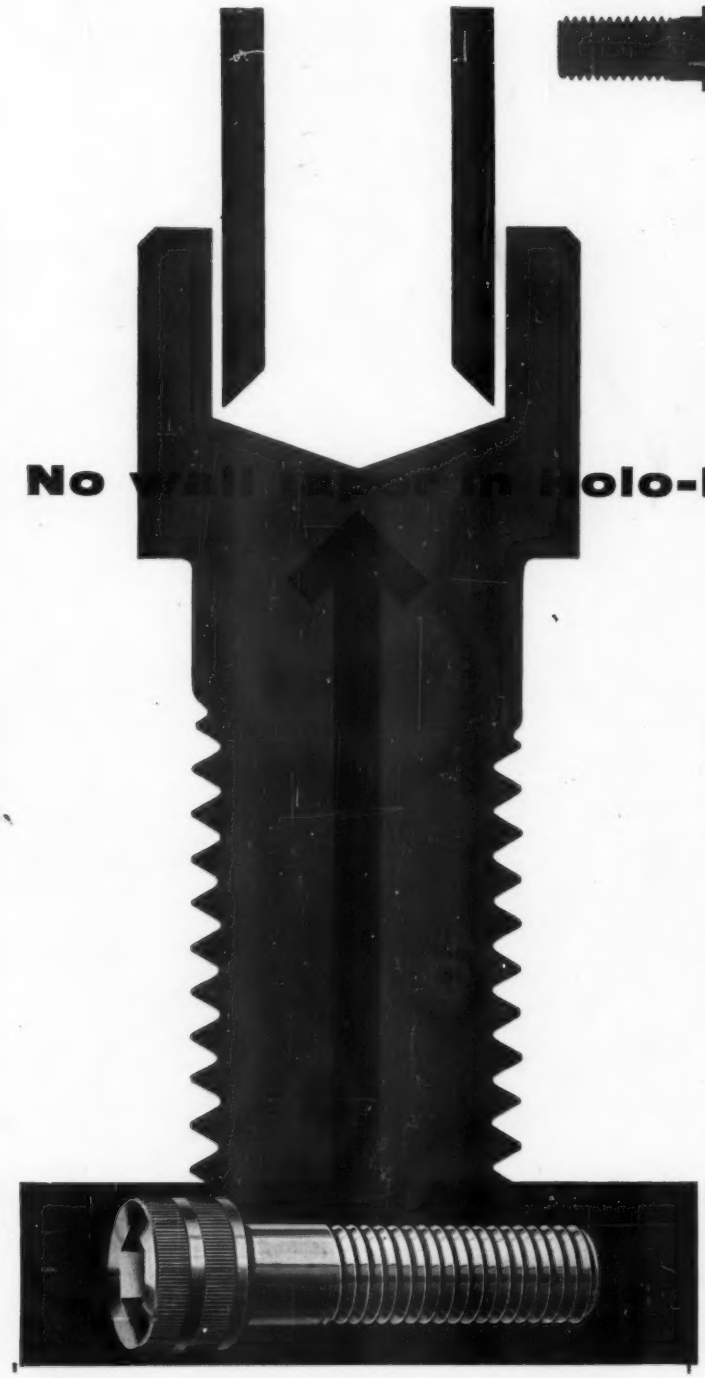


**INSIDE INFO FROM HOLO-KROME**



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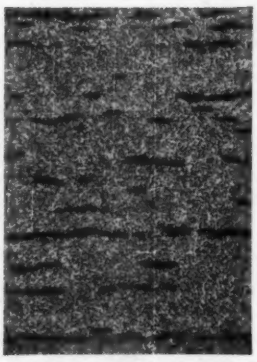

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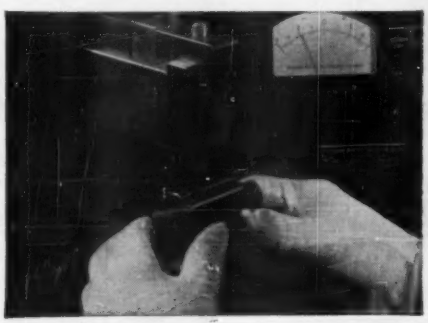

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